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## ENTREPRENEURIAL COMPLIANCE OPPORTUNITIES FOR MARITIME FUEL PRODUCERS <sup>★</sup>

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**Abstract.** In January 2015, the Sulphur Emission Control Areas (SECA) regulations changed so that ships that ply the Baltic Sea and the North Sea must no longer use bunker fuel that exceeds 0.1%. After the regulation of many compliances, changes occurred in the maritime sector, especially in the BSR. From studies, the impact is still somewhat negative for some maritime stakeholders such as small-scale fuel producing companies who must produce fuel that complies with the SECA requirements. The impact analysis of their compliance options shows that hydrodesulphurisation option is the most viable option with a commensurable investment return rate, but it is highly risky and expensive considering the incessant plummeting of fuel price and the financial status of such companies. However, even though the situation looks bleak for the small-scale maritime fuel producers, a more in-depth probe revealed a chance for exceptional opportunities for growth and profit through a change of business model to the maritime energy-contracting model (MEC). The study zooms in on a case fuel producing company, empirically considers and compares the MEC model (as a decentralised option) and the hydrodesulphurisation process (as a centralised option) and, if either option is adopted by as a SECA compliance strategy to ensure a rounded and robust choice making-process for maritime stakeholders in such situations.

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## 1. Introduction

To increase life expectancy and protect the environment from shipping activities the international maritime organisation (IMO) established a Sulphur Emission Control Area (SECA) in Northern Europe including the Baltic Sea (IMO, 2014). Of which, from 1st January 2015, ships must use low sulphur fuel not exceeding 0.1% v/v adopted by the European Parliament (EP) in the Directive 1999/32/EC amended in Directive 2012/33/EU. The EU shipping regulations on sulphur also include waters, ports and any vessel at the quays in EU ports whether they fall in SECA or non-SECA region. The second clause of this regulation imposes that ships in non-SECA waters can only use a maximum 1.5% sulphur content fuel until 2020 when the allowance is further reduced to 0.5 %v/v (IMO, 2016). This occurrence means that shipowners no longer have to operate in SECA before they pay attention to the sulphur content of the fuel their ships use. OECD/ITF (2016) reported that international shipping produced about 80 times more SO<sub>x</sub> emissions than aviation in 2000. As a reactive gas, SO<sub>2</sub> reacts with other compounds to form secondary particles that have dangerous consequences for the health of the inhalers (Duke Energy, 2016). The IMO and the EU parliament are employing a global strategy to bring this situation under control for a safer world. Regulations such as the sulphur regulations aspire to reduce the acidification damage to ecosystems reduce respiratory and cardiovascular diseases and increase life expectancy (AirClim, 2011).

When companies respond to regulations, they focus primarily on their strategies to reduce their cost of complying. Some of their responses are embedded in activities such as research and development, expansion, equipment upgrade and processes. Since the introduction of the SECA regulations, substantial changes are made with vessels that operate in the Baltic Sea who now use fuel that is low in sulphur content (Wiśniewski, Czernański, Drożdziejki, Matczak, Spangenberg, 2014; Bergqvist, Turesson & Weddmark, 2015).

The compliance rate has been very commendable, and the overall economic impact of SECA has been negligible. However, despite the impressive changes witnessed, the impact may not be the same for all stakeholders, and there is still not a clear-cut conclusion on the most economical options for the shipowners. Moreover, some results show that the effect may be harmful to medium size fuel producers who have to deal with producing low sulphur fuel which is distillate oils and expensive to refine (EfficienSea2, 2016). These fuel producers must make tough strategic business decisions linked to high investments and severe financial risks to remain functional in the maritime fuel markets.

Against this background, stimulating innovation in the maritime sector to ensure a cleaner environment is crucial and technological development may be able to show the way out of some persistent environmental problems. However, technical solutions may not necessarily translate to profit outcomes if innovative choices are not considered carefully. Since successful value propositions are embedded in exceptional business models (Osterwalder & Pigneur, 2009), the SECA regulations could signify the opportunity for innovative responses that are useful for the maritime market. Olaniyi, Prause & Gerber (2017) proposes the Maritime Energy Contracting Model (MEC), a new business model that uses the scrubber installation on ships for fuel producers and shipowners.



However, the concept still leaves a doubt of whether it can bring economic advantage to fuel producers when compared to other methods such as the hydrodesulphurisation process for sulphur removal.

Thus, the core objective of this study is to make a comparative analysis of the capital and the operating costs between the maritime energy contracting (MEC) model – viewed as a decentralised method of sulphur removal process – to the construction of a hydrodesulphurisation plant – viewed as a centralised option for SECA compliance for this study. In this perspective of controlling sulphur emissions, the paper builds on the insights of Olaniyi, Atari & Prause (2017) and Pourmoghaddam et al. (2016) to evaluate the economic parameters of the MEC model and hydrodesulphurisation process for SECA regulation compliance. The research uses the case of Viru Keemia Grupp AS (VKG) an Estonian shale oil (popular as bunker fuel) producer that has a sulphur content that exceeds both the SECA and the global sulphur emissions limit. VKG now faces the challenge of producing the 0.5% or 0.1% sulphur content fuel to meet the demand of the sulphur regulation. On this premise, this study is channelled towards creating an enabling situation for medium-sized maritime fuel producers to make definitive decisions regarding their path of SECA compliance. All research activities were made in the frame of “EnviSuM” - Environmental Impact of Low Emission Shipping: Measurements and Modelling Strategies project.

The structure of the paper is in the following manner; the next section discusses the Sulphur regulations and the activities of the maritime sector stakeholders in their bid to comply with the environmental stipulations and their dilemma when making compliance related investments decisions. Section 3 describes the method used for the research. Section 4 examines the cases of using the decentralised (MEC) compliance model and the centralised (hydrodesulphurisation) business model. The authors highlight the intricacies of each model and their costs as compliance pathways for fuel producing companies. Section 5 draws on the results and discusses the merits and demerits of using the model when compared to the existing knowledge of entrepreneurial opportunities regarding the SECA regulations. The last section concludes.

## **2. Compliance Options for Sulphur Emissions Regulations**

The efforts to reduce the compliance costs forces maritime stakeholders like shipowners, ports and fuel producers to look for innovative ways to adhere to the stipulation of emission reductions and at the same time venture into activities that can increase their capital base and gain new business opportunities (Wiśnicki et al., 2014, EfficienSea2, 2016). Primarily, three paths exist for the shipping industry to comply: one is fuel switch to low sulphur fuels, the other is to alternative sources of fuel, and the last is to install abatement technologies on ships (OECD/ITF 2016).

The low sulphur fuel switch requires that ships use the more expensive and cleaner low sulphur fuel (marine diesel oil (MDO), marine gas oil (MGO) or the ultra-low sulphur fuel (ULSFO) that can be treated to reach a maximum sulphur content of 0.1% (IMO, 2013, 2015). Using low sulphur fuel does not require any significant investments for remodelling ship engines, except for minor adjustment of pipes and other accessories. In some instances, large ships could also choose a hybrid system by installing dual engines that allow them to switch from high to low sulphur fuel whenever they are within or out SECA (Berqqvist, et al., 2015). Seemingly, the easiest solution to the sulphur regulations would be to switch to the use of low sulphur fuel but according to Atari & Prause (2017), the constant erratic fluctuations of fuel price, uncertainties regarding effects of newly introduced regulations such as the 2020 global sulphur cap, makes this option very risky.

The liquefied natural gas (LNG) is a type of non-fossil fuel used as an alternative source of energy for shipping. Its use has been widely accepted as a promising energy source for shipping to solve the sulphur emissions dilemma because the LNG is less costly when compared to the distillate oils and the heavy fuel oil, however, the costs of distributing LNG to ports and ships are very high (Brynnolf et al., 2014). Furthermore installing the LNG engine on ships is quite expensive, so many shipowners avoid this option as their choice for compliance.

A ship scrubber is a cleaning system that washes sulphur from the exhaust of ships that use heavy fuel oil. There are two types of scrubbers, the dry and the wet scrubber (OECD/ITF 2016). The wet scrubbers are of three types, the open loop, closed loop and the hybrid system. The hybrid scrubber integrates both the open and closed-loop systems to function as one. Atari & Prause (2017) explain that the initial investment costs of scrubbers retrofit range from 3 to 5 million € depending on the ship type, scrubber type and size. Besides, operating the scrubbers increases the fuel consumption rate of the ship engine to about 5% (EMSA, 2010). The scrubber needs space for installation and space for equipment for wash water, piping systems and monitoring on the ship making it possible to use the scrubbers only in large vessels (Berqvist et al., 2015).

Compliance with regulations often leads to the dilemma of investment choices and sudden market changes may interrupt a company's usual *modus operandi* which may lead to intensive capital investments and increased operational costs associated to new and changed personnel, materials purchased, legal costs, paperwork and so on (Demil & Lecocq, 2010). Since investments, choices have a significant effect on a company; wrong investment decision can cause adverse setbacks and warrant years of recovery. In other words, strategic actions related to regulatory compliance of an enterprise is very crucial (Prause, 2014).

The endogenous growth theory builds on this premise and suggests that the economic growth of a country is primarily dependent on the decisions made by the actors in the economy—firms and individuals—rather than on external factors (Barro, 1991). Distortions that could adversely affect entrepreneurial activities have great significances for the growth of any economy (Solow, 1994). Thus, the innovation that stems from various compliance activities is a key driving factor for economic growth and social wealth. In this light, the innovative products and services emerge more often because of a cross-sectorial combination of technologies, design and business models (Olaniyi & Prause, 2016).

Jaffe, Peterson & Stavins (1995) argued that regulatory decisions are too time-consuming and are often characterised by litigation and other legal power struggles that could last for decades of reforms leading to high transaction costs. They insisted that regulatory interventions influence investment choices that ultimately have a significant effect on the economy because the build-up of regulations over time often leads to duplicative, conflicting, and even contradictory outcomes. Other work (Martin and Sunley, 1998) agrees that the multiplicity of regulatory constraints complicates and distorts the decision-making processes of companies or stakeholders operating in such an economy.

In contrast, the OECD (2005) refuted these views on regulations and its effects on the premise that even though enterprises are sometimes subjected to series of obligations through regulations, regulations should not be seen in a negative light but be considered as necessary legal impositions needed to control the ways businesses are conducted. Regulations may sometimes bring financial loss, but they also create a type of stability connected to more extensive macroeconomic benefits such as GDP increase, competitiveness and productivity effect and unquantifiable benefits like protection of fundamental rights, social cohesion, international and national economic stability (Renda et al., 2013). Related stakeholders should focus instead on the continuous adaptation and improvement that will evolve in ways that can put their organisations in active stances rather than in reactive states (Eisenhardt & Brown, 1998).

Overall, there is still no academic cut consensus on whether the maritime fuel producers might substantially change their business model and operating strategies to the most viable option with a commensurable investment that maximises the matching return versus risk, about their path of producing SECA compliant fuel and their financial situation. Therefore, addressing this issue is paramount to draw useful regulatory and policy implications regarding the SECA compliance at the shipowners and fuel producers' level, and more particularly to accurately reinvigorate the implementation of new business and management strategies, and assessing their impacts for the industry as a whole.

### **3. Methodology**

The scope of this study is to analyse the differences in the operating costs of the maritime energy-contracting model and the hydrodesulphurisation process, both of which are presented as strategic compliance models for the sulphur regulations compliance using the case of VKG. The analysis will help to determine the merits and demerit of each model for investment choice purposes for medium size fuel producers.

#### **3.1. Survey design and data collection**

All data collection took place between May 2016 and May 2018 in the frame of the “EnviSuM” project. First, document review was conducted to understand the background of the sulphur regulations, the hydrodesulphurisation process of sulphur removal and the energy service-contracting model. This process also substantiates respondents’ reports to provide a rich account of events (Esterberg, 2002). Next, twelve (12) face-to-face structured and semi-structured experts’ interviews were made. Discussions lasted between 1 to 2 hours with notes taking. Where clarifications and validations were needed, follow-up phone calls and emails were made. The interviews made gave room to identify proficient information from experts that Patton (2002) called “key informants” who are familiar with the subject matter and have useful perceptions for full comprehension of events.

Yin (2009) and Stake (2000) said that the triangulation of results is crucial to creating a reliable case study and helps to converge accurately and present experts opinions. In this light, additional data and information were gathered from BSR maritime experts’ focus group meetings and EnviSuM learning café workshops to improve data and create a robust case. Osterwalder (2014) nine-block business model canvas was used to highlight the expected change in the business model of the case company after the adoption of the proposed energy service-contracting model.

Purposeful sampling (Patton, 2002) was used to select top management executives in their respective fields. Patton defined this process as “a selection strategy where particular settings, persons or activities are chosen deliberately to provide information that cannot be gotten otherwise”. This selection criterion for top management executives was drawn because they are involved in everyday decisions and are vast in management experience. The interviews targets three categories of respondents; the managers in VKG who could give the account of their various SECA related activities as well as the economic impact of the SECA regulations on their business performance, the energy servicing managers and consultants, who are familiar with the complexities of energy management and the shipowners who buy the low sulphur fuel.

Data from the interviews, the focus group meetings and document reviews were analysed using Yin's (2009) "five components of effective case study research design," i.e. research questions development; scientific propositions; unit analysis and coding; connecting logic and themes and interpretations of findings.

#### **3.2. Modelling**

##### **3.2.1. Business model design of the MEC package**

Olaniyi et al. (2018c, 2018b) studied the case of the decentralised desulphurisation on a ship with scrubber technology using the MEC modular design, comprising different modules of the ESCO.

$$MEC Price_t = Fuel cost_t + Scrubber costs_t + Adjustments_t \quad (1)$$

Where the MEC costs are calculated within the comprehensive competitive technical solutions and prices offered regarding the functional description of the energy services, scrubber costs as the capital costs of the scrubber installation spread into an amortisation over the lifespan of the scrubber and added to the fuel cost per metric tonne. Fuel price is the consumption of HFO at the current price level related only to the marginal costs defined exclusively in the service contract. Adjustments are the additional margin for running the scrubber comprising of all costs for the scrubber usage such as administration, maintenance, personnel, insurance and management together with entrepreneurial risk, including a profit margin. Adjustments open a negotiation space with the customer and take into account the costs of the asset, inflation and modifications in the employee's salary as well. In principle, every year, 50 % of the price is stable, where 30% is dependent on current inflation (consumer good index). The remaining 20% depends on salary costs build-up that will affect the provided services like maintenance and monitoring during the contract period.

### 3.2.2. Business model design of the HDS plant

In this analysis, the authors devote special attention to estimating the overall annualised cost (OAC) and the final price per metric tonne of low sulphur fuel oil based on the hydrodesulfurisation process of VKG. Recent literature and common practice were used to estimate the OAC using the following equation according to Pourmoghaddam et al. (2016); Coker (2015); Towler & Sinnott (2012):

$$OAC_t = Total annual capital cost_t + Total annual operating cost_i \quad (2)$$

Where, the total annual capital cost (TACC) is the discounted value of the financial cost for year t calculated by including a set of capital investment costs related to the HDS unit, which mainly considers: physical plant cost (i.e. subsumes investment of significant equipment, piping, structures and site development costs), engineering costs and contingency costs. In a similar vein, the total annual operating cost (TAOC) for a given year t sums-up total fixed operating costs (i.e. labour force, maintenance, taxes) and variable operating costs (i.e. fuel, electricity, cooling water). Even though the TACC and the TAOC are observed, they are not necessarily constant over time. Thus, the authors account for time effects by discounting all future costs out-flows resulting from operating the HDS unit.

## 4. Result

### 4.1 Case study: Investment Dilemma of a Fuel-Producing Company

The study uses Viru Keemia Grupp AS (VKG) an oil shale producing company in Estonia, situated in Ida-Viru County, a 148,000 populated area of Estonia a small country located on the Eastern border of European Union (EU) close to the Baltic Sea. Due to the oil shale production, Estonia is the least energy importation dependent country in Europe (Eurostat 2016). The country predominantly uses 78.3% of solid fuels to produce energy - mainly oil shale. Oil shale covers about 65% of the country's needs for primary energy that guarantees the energy independence of Estonia. While the EU imports 53.4% of its total consumed energy, Estonia relied on only 11.9 imports for its energy requirements.

Oil shale industry contributes about 4-5% to the Estonia GDP and about 300M € to the state budget (including employment taxes, environmental taxes) (Eesti põlevkivitööstuse aastaraamat, 2014). As a producer of shale oil, VKG has a significant impact on the Estonia economy. In 2015, VKG's contribution to the state budget of Estonia

was about €35 Million, and the Company's total turnover was €167 million. From the turnover, €87 million was a contribution from shale oil alone. As of 2015, VKG has employed over 2100 employees.

Regrettably, while shale oil has a low sulphur content comparable to crude oil, its sulphur content of 0.8% is still higher than the 2020 global sulphur limit of 0.5%, more, so the SECA limit of 0.1%. VKG has found its self in a position where it must assess the present marketability of its oil products post-2020. A critical challenge for them is how to cope with the existing production capacity that pressures them to upgrade their refining process to meet up with their significant markets. Another is the complication in accessing appropriate credits due to the low oil price and the complicated developments in maritime fuel markets. Other financial problems are related to the high risks involved in financial investments (Olaniyi & Viirmäe, 2016; Prause & Olaniyi, 2017). Because of these magnified and complicated circumstances, having a new business model is critical. Strategic business agility should be taken lightly by VKG if they want to avoid the vicious cycles that could lead to precarious financial performance (Yauch, 2011).

After the introduction of SECA regulations in 2015, the demand for abatement technologies especially the scrubber did not increase as was predicted before 2015 (Olaniyi et al., 2017). According to them, current figures show a decrease in scrubber installations due to low bunkering prices. Most shipowners would instead use the low sulphur fuel reducing the demand for HFO and exerting much pressure on fuel producers like VKG who must come up with compliant fuel to meet the demands of the market for low sulphur fuel.

According to Atari & Prause (2017), investing in scrubber technology have the potential to be a profitable undertaking for the shipowners. However, most shipowners are reluctant to make the financial commitment for scrubber installations, which coincide with the situation of the fuel producers whose product may no longer be marketable. In the end, to reduce the investment risks for the shipowners and to ensure business continuity for the fuel producers, a change of their business model could be a welcome development by both parties.

## **4.2 The Maritime Energy Contracting Package (MEC)**

### **4.2.1 Change in the business model for VKG**

Since the case of VKG reveals that coping with SECA regulation is plagued by high investments risk, Olaniyi, Prause & Gerber (2017) introduced the Maritime Energy Contracting (MEC) using the scrubber technology investment on a ship as a promising new model to overcome this dilemma. The concept of the model highlight how VKG can metamorphose from being fuel producers to also an energy service provider to safeguard SECA compliance. The MEC idea is to deliver the conventional high sulphur fuel to contracted ships, pre-finance the project, and run the scrubber installation. The primary motivation of this model is to lower the transaction (compliance) costs that emanate from SECA regulations of both the fuel producing companies and the shipowners. The proposed model proposes a shift of the fuel company focus towards selling “energy solutions” using the scrubber installations on ships.

The Energy Service Company (ESCO) is an inclusive energy service model used to achieve energy efficiency to optimise cycle cost in building projects (Bertoldi, Rezessy & Vine, 2006). Typically, an ESCO covers the customised service package like design, building, (co-) financing, operation & maintenance, optimisation, fuel purchase, user motivation in place of their customers (Sorrell, 2007). The ESCO also takes on the technical implementation and operational risks in the course of the project term (Bleyl & Schinnerl, 2008). At the initial stage, an energy baseline costs (energy usage before project) is predetermined, and energy is supplied at the agreed price that ensures efficient use of energy and a shared savings assurance. The overall payment guarantees the outcome and the overall costs of services rendered and certifies energy usage and supply that can create the inducement to optimise the use of the supply facility (Goldman, Hopper & Osborn, 2005).



Transferring this concept to the maritime industry using the scrubber installations on ships, the MEC model is developed where the fuel company takes on the implementation and operation of the energy service package at its expenses and risk according to the project specific requirements set by the customer. For its profit, it will receive payment for the energy (fuel) delivered, which depends on the consumption of the ship together with the flat rate costs of service, maintenance and quality assurance. The profit is shared between the fuel producer and the shipowner during the contract lifetime. The MEC guarantees cost savings so that the payback from the cost savings from the fuel supplied throughout the contractual period covers the investment and the risks costs by the fuel company.

By zooming in on the building blocks of Osterwalder (2004) business model, one first thing that would change in the MEC business model are the key partners for the fuel company. This change will mean a switch from bunker traders to financial houses, scrubber producers, maintenance companies, ship operator/shipping company/shipping operators and other fuel producing companies. Next, the key activities will become service driven to marine fuel production, new solution services to sulphur emission compliance, maintenance, and data information exchange and information management. The company's key resources together with the general physical infrastructure like the mines and fuel production facilities will now include the scrubber and intellectual and financial resources, i.e. scrubber experts, service personnel and liquid assets.

Furthermore, the value proposition of the fuel company will change from delivering quality only HFO fuel based on economies of scale concept towards economies of scope. In this case, the production of the traditional HFO will continue, but also, the product portfolio now extends to scrubber related services comprising design, installation and running in the form of a full service-bunkering offer. This full-service bunkering delivers the necessary scrubber to the shipowner including all related services and a cost and risk reduction, which is, related to the investments costs. The costs reduction made for the shipowner will yield financial savings for the fuel producing company and lowers HFO prices due to the removal of intermediaries. The company's significant customers will switch from bunker fuel traders to shipowners.

Customer relationships will become a co-creation alliance between the company and its contractual customers. Services will include personal assistant, maintenance and customised design installation that fit each customer according to their needs. The channel of distribution will remain owned but will involve the use of electronic data exchange (EDI) for inventory and supply management. Cost structure will change from fixed dominated fuel production to more diversified costs due to the new economics of scope activities related to the service offered to shipowners. Finally, the revenue streams related to fuel

#### 4.2.2. Costs of MEC

The analysis of the MEC model raises the question on the costs of the additional costs per ton fuel when using a scrubber aboard. A RoPax ferry ship that plies Tallinn-Helsinki route, with a daily fuel (HFO) usage of 50mt daily, as a ferryboat operates in 340 days a year equalling 17,000mt fuel annual usage is used to calculate this additional cost for this study. The annual scrubber cost is a 10% additional scrubber fuel p.a., 2%, additional scrubber service p.a. and annuity including 15 years depreciation of scrubber p.a. and 6% interest costs. The scrubber cost is considered as the main component of the MEC model, because of the focus on the long-run economic evaluation. Then, taking into account both the operational and financial costs related to operating scrubber, we estimate for each calendar year  $t$  the total scrubber costs, over the lifespan period, as follows:

$$\text{Scrubber Costs}_t = 0.1 \times \text{HFO Cost}_t + 0.02 \times \text{Scrubber Price}_t + \text{Annuity}_t \quad (3)$$

Formally, scrubber costs constitute a forward-looking measure that sum-up the expected stream of operational and financial costs, which characterise a scrubber's expenses-generating potential beyond the total fuel consumption and adjustment cost at the end of year  $t$ . In order to calculate the additional costs for each scrubber cost per tonne, a constant annuity over the overall investment period is inputted. This leads to equation (3):

$$\frac{Annuity_t}{(1+r)^T} \cdot \frac{(1+r)^T - 1}{(1+r) - 1} = \sum_{t=1}^T \frac{oCF_t}{(1+r)^t} - CapEx_0 \quad (4)$$

Where,  $oCF_t$  is the expected outflowing cash flow generated in year  $t$  since only the expenditures have to be considered over the  $T$  investment period (i.e. 15 years); the term  $(1+r)$  is in the finance literature called the discount factor, and  $CapEx_0$  is the capital expenditure, which corresponds to the initial capital investment in a SOx scrubber. By solving Eq. (3) so assuming that the annual fuel consumption for the ship is constant over the years, the division of the annual annuity by the number of consumed fuel tons delivers the additional costs for scrubbing aboard (Ryan & Ryan, 2002; Ross et al., 2004; Di Lorenzo et al., 2012).

Besides, for more realistic quantitative outcomes, the empirical set-up of the equation (2) in this analysis implies incorporating a set of dynamic variables that directly affect the anticipated operating and financial cost valuations over the operating period. Therefore, the pricing of the scrubber costs is built upon the assumptions that the fuel prices (HFO) are exogenous and follow a random walk. All effective costs are adjusted for the annual inflation rate and discounted at a rate of 11% per year, which is defined by disregarding the composition of the company's funding sources. This assumption could strongly influence the project results. Therefore, bearing in mind these, in this case, the results of the project evaluation are reported in Table 1.

Results reveal that the scrubber costs which is the average annual scrubber cost over the 15 operating years discounted by the discounted rate (WACC) will cost costs of 36.25€ per metric tonne for VKG. The cost analysis for the scrubber is shown in table 1.

**Table 1.** Cost analysis for a new scrubber over the entire period

Variable	Value €
Investment costs	5 684 000.00
Average annual scrubber costs	725 667.02
Capital scrubber costs per metric tonne	14.17
Operating scrubber costs per metric tonne	23.02
Scrubber costs per metric tonne	36.25

*Source:* Authors' calculations

Importantly, the differences in magnitudes between the independent results of the first year and the aggregated results over the economic life of the new scrubber (i.e. 15 years) are mainly due to the time effects and the discounted out-flows (costs), as well as the digressive financial annuity scale. The study exclusively considers the scrubber costs as a significant component of the MEC model, because of the focus on the long-run economic evaluation. The authors took into account the operational and financial costs related to the scrubber, the estimate for each calendar year, the total scrubber costs, over the lifespan period was made according to Atari & Prause (2017); Atari, Bakkar, Olaniyi & Prause (2019).

So far, the MEC concept highlights many advantages for fuel producers as well as for shipowners because it allows fuel producers to continue producing their traditional product whereas the shipowners gain a competitive advantage due to lower energy costs in shipping that generates additional margin in freight rate. This concept leaves a doubt of whether a decentralised MEC model through the scrubber installations on a ship could be more favourable than a centralised HDS in the fuel producer's plant from an economic viewpoint.

### 4.3 Hydrodesulphurisation

In a previous study, Olaniyi & Viirmäe (2016) proposed five potential business models for VKG. (1) Upward vertical integration where VKG sells fuel directly to suppliers instead of through an intermediary. (2) Products upgrade by building a new refinery to yield commercially valuable products which would cost VKG about 400 million€ with additional annual 5% depreciation of 20 million€. (3) Products discount where VKG sells at a discounted rate. (4) Process innovation, which is the implementation of an improved production method. (5) Hydrodesulphurisation which will cost the company about 100 - 150 million€ investment.

After the empirical assessment of these investment options, Olaniyi & Viirmäe discovered that out of the five options, only hydrodesulphurisation and the product upgrade would yield a meaningful return on investments but with high risk. Of the two, hydrodesulphurisation option has the highest return on investment and a lower risk making it the most favourable option for VKG. This work accesses the costs of running the hydrodesulphurisation plant to compare to the MEC using the scrubbers.

Hydrodesulphurisation (HDS) is a multi-catalytic chemical process used to remove sulphur compounds from refined fuel used for vehicles, aircraft, ships, after the SECA regulations (Lee, Ryu & Min, 2003). Lin et al. (2010) and Pourmoghaddam, Davari, Moghaddam (2016) linked the earliest production of low sulphur fuel through the hydrodesulphurisation process to China (the mid-1950s) and Japan (early 1960s). Afterwards, different improved processes were developed and even though the catalytic hydrodesulphurisation processes have been the most widely used process, other alternative processes like extractive desulphurisation, extraction with ionic liquids, adsorptive desulphurisation with solid adsorbents, bio-desulphurisation, supercritical water-based desulfurization, and electrochemical desulfurization became popular (Pourmoghaddam et al., 2016).

During the catalytic process, organic sulphur compounds react with hydrogen ( $H_2$ ) to form hydrogen sulphide ( $H_2S$ ) using metal catalysts at high temperature and pressure. According to Erickson (2003), HDS has low operating costs but high capital costs that may be too expensive for refineries that recover less than 20 tons of sulphur per day. This complicated process incurs high material usage because the HDS requires a lot of  $H_2$  so that the production and operating costs are relatively high (Lin et al., 2010) especially for a medium scale company like VKG. Since VKG has a possibility of the building a hydrodesulphurisation plant, particularly with the incoming 2020 global cap, the authors follow the approach of Pourmoghaddam et al. (2016) to perform an economic analysis in a possible case of VKG pursuing this centralised project.

#### 4.3.1. Costs of the HDS plant

The investment analysis was made given a total capital investment of €150 million, a production capacity of 750 000 tonnes of the ultra-low sulphur fuel oil (ULSFO) per year and 330 operating days of per year. Similarly, the authors present the assessments of the aggregated costs estimated for the entire operating period (i.e. 20 years). Using the typical lifetime of an HDS plant of 20 years and assuming an average interest rate for this investment period. While the investment costs of a hydrodesulphurisation plant for VKG range between €100 and €150 million, the authors adopt an upper-value calculation of €150 million as the cut off threshold for calculation. Therefore by assuming the standard VKG's annual production volume of 750 000 tons of fuel, the economic and cost analyses (Table 2).



**Table 2.** Cost analysis for a new HDS plant over the entire period of investment

Variable	Value €
Investment costs	150 000 000
Average overall annualised costs	20 870 000
Capital HDS costs per metric tonne	9.93
Operating HDS costs per metric tonne	17.89
Overall HDS costs per metric tonne	27.28

*Source:* Authors' calculations

By scaling the estimated costs by the annual fuel production, the results exhibit the overall costs of hydrodesulphurisation in term of euros per tonne of ULSFO produced equals to €27.28, while the unit capital cost per ton of ULSFO equals approximatively €9.93, which represents 34% from the overall additional HDS cost. Besides, a transfer of the operating costs calculation of Pourmoghaddam et al. (2016), to the current operating conditions of VKG HDS plant leads to an additional unit operating cost of approximately €17.89 per ton of ULSFO so that in the considered case, it represents 66% from the overall additional centralised hydrodesulphurisation costs. In sum, this analysis provides different exciting insights regarding the additional costs related to the centralised hydrodesulphurisation vis-à-vis the costs for the decentralised MEC model.

## 5. Discussion

The study led to significantly different overall costs (that sum up the operating and capital costs) between the decentralised MEC model and the decentralised HDS process. Hence, the decentralised MEC model costs €36.25 per metric tonne, while the decentralised HDS process represents a cost of €27.28 per metric ton of fuel. By matching the results, the figures gave interesting outcomes as other options have different investment characteristics. For example, the central HDS plant costs about €150 million and enjoys a lifetime of 20 years, whereas the scrubber installation on a ship RoPax ferry costs about €5 million and has a lifetime of 15 years (Olaniyi et al., 2018c, 2018b, 2018a). Also, the additional operating scrubber cost in terms of euros per metric tonne remains significantly higher with regards to the unit operating cost attributed to the HDS plant. However, on the whole, the results are rational, in terms of the scope and the size of the initial investment. A €150 million investment in HDS plant is equivalent to 30 investments in scrubbers for ships like the RoPax ferry suggesting that the scrubber installations on ships are related to lower financial investment volumes and financial risks which are diversified and less when compared to the risk of a single HDS capital investment.

Even though the calculation for centralised and decentralised desulphurisation was done from two specific cases, these results bear valuable insights that will guide decision-makers on the evaluation of the real costs of the sulphur regulations investments options. It will also support the optimal investment choice, thus, aid to argue the optimal financing strategy for the maritime stakeholders. Besides, the decentralised MEC model under the considered circumstances is perhaps more favourable due to the scalability of the investments. A more detailed investment analysis had shown that the payback times for the MEC investment as well as for the HDS plant investment are about 2.5 years (Atari et al., 2019), assuming the current spread of about €150 between MGO and ULSFO. This additional information again supports the scrubber installations using the MEC model due to shorter capital binding periods.

According to Utterback (1994), in situations characterised by a high investments risk where the priority is to minimise costs to obtain greater operational efficiency, smart fuel management and strategic partnership could be

a marketing strategy to handle the challenge. A significant benefit for the MEC model is the exchange of the capital expenditures (CapEx) to the operational expenditures (OpEx) that signifies an indirect investment for the fuel producing company. In comparison to the vast production plant investment, the new investments sums for the scrubber installations are smaller and better to handle.

Similarly, a smart fuel price management will represent a competitive advantage for the shipowners who will also benefit from the MEC model since it has a significant influence on the overall shipping operating costs and influences the margin of freight rates. It also opens the space for negotiations in cargo transportation that might be welcoming in the shipping sector due to low freight rates experienced in recent years (SSE, 2016). In other words, there is an arbitrage for the investor to invest heavily and gain on the operating cost or to reduce investment and enjoy a lesser investment cost, risk, and gain a much lower operating cost.

## **6. Conclusion**

The downward fuel price fluctuations have already adversely affected maritime fuel producing companies. Hence, they must proceed tactically on investments decision they make towards the SECA and the 2020 global sulphur limit. The shipping industry as a whole must find a way to cope with the economic impact of the regulations to ensure the industry's sustainability.

The paper provided answers to some of the concerns regarding abatement technology in maritime. First, it highlighted that the operating costs of both MEC and HDS per metric tonne are nearly the same but with quicker payback for the MEC model using the scrubber technology. Better still, the work showed that the risk of investment in the MEC model is lower due to a reduced and scalable amount of investments. In this situation, the MEC model could pave the way to a win-win situation among the involved maritime stakeholders by combining technical solutions to a business model innovation, presenting a cost-effective and risk minimising route to overcoming barriers to SECA compliance for fuel producing companies as well as for shipowners.

By comparing the MEC and HDS options, the paper presents the opportunities that are both inherent and external to the case company and promotes a viable private sector that targets major maritime stakeholders thereby contributing to regulations driven innovations. It also contributes to the ongoing discussions on the impact of sulphur regulation on maritime business. A pathway for further studies can be towards the systematic exploration of how the MEC is structured from a ship owner's point of view to achieve successful partnerships in the maritime industry.

**References:**

- AirClim. 2011. Air pollution from ships. <https://www.transportenvironment.org/publications/air-pollution-ships-0> Air Pollution & Climate Secretariat Seas at Risk Bellona Foundation North Sea Foundation Transport & Environment European Environmental Bureau.
- Atari, S., Prause, G. 2017, October. Risk assessment of emission abatement technologies for clean shipping. In International Conference on Reliability and Statistics in Transportation and Communication (pp. 93-101). Springer, Cham.
- Atari, S., Bakkar, Y., Olaniyi, E.O., Prause, G. 2019. Real options analysis of abatement investments for sulphur emission control areas compliance. *Entrepreneurship and Sustainability Issues*, 6(3), 1062–1086. [http://doi.org/10.9770/jesi.2019.6.3\(1\)](http://doi.org/10.9770/jesi.2019.6.3(1))
- Barro, R. J. 1991. Economic growth in a cross-section of countries. *Quarterly Journal of Economics* 106:40755.
- Bergqvist, R., Turesson M. and Weddmark, A. 2015. Sulphur emission control areas and transport strategies - The case of Sweden and the forest industry. *European Transport Research Review* 7(2) <https://doi.org/10.1007/s12544-015-0161-9>
- Bertoldi, P., Rezessy, S., Vine, E. 2006. Energy service companies in European countries: current status and a strategy to foster their development. *Energy Policy*, 34(14), 1818-1832. <https://doi.org/10.1016/j.enpol.2005.01.010>
- Bleyl, J.W., Schinnerl, D. 2008. Energy Contracting to Achieve Energy Efficiency and Renewables using Comprehensive Refurbishment of Buildings as an example.
- Bleyl, J.W. 2009. Conservation First! The New Integrated Energy- Contracting Model to Combine Energy Efficiency and Renewable Supply in Large Buildings and Industry.
- Brynnolf, S., Magnusson, M., Fridell, E., and Andersson, K. 2014. Compliance possibilities for the future ECA regulations through the use of abatement technologies or change of fuels. *Transportation Research Part D: Transport and Environment*, 28, 6-18.
- Coker, A. K. 2015. Ludwig's applied process design for chemical and petrochemical plants. Gulf professional
- Creswell, J. W. 2005. Qualitative research design: An interactive approach (2nd ed.) Thousand Oaks, CA: Sage.
- Demil, B., Lecocq, X. 2010. Business model evolution: in search of dynamic consistency. *Long range planning*, 43(2), 227-246.
- Di Lorenzo, G., Pilidis, P., Witton, J., Probert, D. 2012. Monte-Carlo simulation of investment integrity and value for power plants with carbon-capture. *Applied Energy* 98: 467–478. <https://doi.org/10.1016/j.apenergy.2012.04.010>
- Duke Energy. 2016. Sulphur dioxide scrubber technology <https://www.duke-energy.com/environment/air-quality/sulfur-dioxide-scrubbers.asp>
- Eesti põlevkivitööstuse aastaraamat. 2014. Eesti Energia, Viru Keemia Grupp, Kiviõli Keemiatööstus, TTÜ Virumaa Kolledži Põlevkivi Kompetentsikeskus. <http://www.vkg.ee/cms-data/upload/sise-uudised/eesti-polevkivitoostuse-aastaraamat-2014.pdf>
- EfficienSea2. 2016. Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement. <http://efficiensea2.org/publications/>
- Eisenhardt, K.M. and Brown, S.L. 1998. Competing on the edge: strategy as structure chaos. *Long Range Planning*, 31(5), 786-9.
- Erickson, B.E. 2003. Technology solutions: cutting the cost of sulfur removal. *Environmental Science & Technology*. American Chemical Society. 319A-320A.
- Esterberg, K. G. 2002. Qualitative methods in social research. Boston, MA: McGraw-Hill.

EU Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure. Official Journal of the European Union, L307/1-20.

Eurostat, 2016. Energy dependency in the EU. Eurostat news release. [www.ec.europa.eu/eurostat/documents/.../8.../c92466d9-903e-417c-ad76-4c35678113fd](http://www.ec.europa.eu/eurostat/documents/.../8.../c92466d9-903e-417c-ad76-4c35678113fd)

Goldman, C.A., Hopper, N.C. and Osborn, J.G. 2005. Review of US ESCO industry market trends: an empirical analysis of project data. *Energy policy*, 33(3), 387-405.

Hämäläinen, E., Hilmola, O.-P., Prause, G. and Tolli, A. 2016. Forecasting maritime logistics costs – Will the low oil price remain? In: *Le transport maritime à courte distance (Short-Sea Shipping): Devport 2016 Conference (Le Havre, France)*. Ed. A. Serry, L. Lévêque. Le Havre, France: EMS Geodif, 19–34.

IMO, 2013. Sulphur oxides (SOx)—Regulation 14. [http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-\(SOx\)Regulation-14.aspx](http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-(SOx)Regulation-14.aspx)

IMO, 2014. Third IMO GHG Study 2014, International Maritime Organisation, London, UK.

IMO. 2015. Guidance on the application of regulation 13 of MARPOL annex VI Tier III requirements to dual fuel and gas-fuelled engines. MEPC.1/Circ.854. London.

IMO. 2016. IMO sets 2020 date for ships to comply with low sulphur fuel oil requirement. Press briefing release 28/10/2016. <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/MEPC-70-2020sulphur.aspx> Accessed 30/11/2016

Jaffe, A.B., Peterson, S.R., Portney, P.R. and Stavins, R.N. 1995. Environmental regulation and the competitiveness of US manufacturing: what does the evidence tell us? *Journal of Economic Literature*, 33(1), 132-163.

Lee, S.W., Ryu, J.W. and Min, W. 2003. SK hydrodesulfurization (HDS) pretreatment technology for ultralow-sulfur diesel (ULSD) production. *Catalysis Surveys from Asia*, 7(4), 271-279.

Lin, L., Hong, L., Jianhua, Q. and Jinjuan, X. 2010. Progress in the technology for desulfurization of crude oil. *China Petrol. Process. Petrochem. Technol*, 12, 1-6.

Martin, R. and Sunley, P., 1998. Slow convergence? The new endogenous growth theory and regional development. *Economic geography*, 74(3), 201-227.

Notteboom, T. 2010. The impact of low sulphur fuel requirements in shipping on the competitiveness of ro-ro shipping in Northern Europe. *WMU Journal of Maritime Affairs* 10(1), 63–95.

Nugraha, F. 2009. Effective implementation of emission control area towards cleaner shipping operations: focusing on sulphur oxides (SOx) emission reduction.

OECD. 2005. International standard cost model manual. Measuring and reducing administrative burdens for businesses.

OECD/ITF. 2016. Reducing Sulphur Emissions from Ships: The Impact of International Regulation. <http://www.itf-oecd.org/reducing-sulphur-emissions-ships-impact-international-regulation>

Olaniyi, E., Prause, G. and Boyesen, J. 2017. Economic Impact of SECA Regulations on Clean Shipping in the BSR- First Empiric Results from EnviSuM Project. Proceedings of 2017 International Conference on Maritime Energy Management. World Maritime University, Malmo, Sweden January 2017.

Olaniyi, E.O., Prause, G. K. 2016. Baltic-Russian Innovation Cooperation in the Context of the EU Eastern Partnership. In T. Kerikmäe & A. Chochia (Eds.), *Political and Legal Perspectives of the EU Eastern Partnership Policy* (pp.257-279). Switzerland, Springer International Publishing.

Olaniyi, E.O., Viirmäe, M. 2016. The Economic Impact of Environmental Regulations on a Maritime Fuel Production Company. *Research in Economics and Business: Central and Eastern Europe* 8(2), 58-84. <http://www.rebcee.eu/index.php/REB/article/viewFile/93/77>

- Osterwalder, A. and Pigneur, Y. 2009. Business Model Creation. Modderman Drukwerk: Amsterdam, The Netherlands.
- Osterwalder, A. 2004. The Business Model Ontology-a proposition in a design science approach.
- Patton, M. Q. 1987. How to use qualitative methods in evaluation (2nd ed.). Newbury Park, CA: Sage.
- Pourmoghaddam, P., Davari, S. and Moghaddam, Z.D. 2016. A technical and economic assessment of fuel oil hydrotreating technology for steam power plant SO<sub>2</sub> and NO<sub>x</sub> emissions control. *Advances in Environmental technology* 1, 45-54.
- Prause, G., Hunke, K. 2014. Sustainable Entrepreneurship along green corridors. *Entrepreneurship and Sustainability Issues*, 1 (3), 124–133, [http://doi.org/10.9770/jesi.2014.1.3\(1\)](http://doi.org/10.9770/jesi.2014.1.3(1))
- Prause, G. 2014. Smart Specialization and EU Eastern Innovation Cooperation: A Conceptual Approach, *Baltic Journal of European Studies* 4(1), 3-19. <http://doi.org/10.2478/bjes-2014publishing>
- Renda, A., Schrefler, L., Luchetta, G., and Zavatta, R. 2013. Assessing the Costs and Benefits of Regulation. Brüssel: Centre for European Policy Studies. Online erhältlich unter: [http://ec.europa.eu/smart-regulation/impact/commission\\_guidelines/docs/131210\\_cba\\_study\\_sg\\_final.pdf](http://ec.europa.eu/smart-regulation/impact/commission_guidelines/docs/131210_cba_study_sg_final.pdf)
- Repetto, R. 1990. Environmental Productivity and Why It Is So Important, *Challenge*, Sept.- Oct. 33(5), 33-38.
- Ross, S. A., Westerfield, R. W., Jaffe, J. F. 2004. Corporate finance. (7th E). New York: Mc-Graw- Hill.
- Ryan, P.A., Ryan, G.P. 2002. Capital budgeting practice of the fortune 1000: How Have Things Changed. *Journal of Business and Management*, 8, 389-419.
- Solow, R.M. 1994. Perspectives on growth theory. *The Journal of Economic Perspectives*, 8(1), 45-54.
- Sorrell, S. 2007. The economics of energy service contracts. *Energy Policy*, 35(1), 507-521.
- SSE, 2017. Shanghai Shipping Exchange Freight indices. <http://en.sse.net.cn/indices/ccfinew.jsp>
- Stake, R. E. 2000. The art of case study research: Perspectives on practice (2nd ed.). Thousand Oaks, CA: Sage.
- Stopford M. 2009. Maritime economics 3e. 2nd Routledge London and New York. 2nd Edition. 2009.
- Talja, S. 1999. Analyzing qualitative interview data: The discourse analytic method. *Library & information science research*, 21(4), 459-477.
- Towler, G., Sinnott, R. K. 2012. Chemical engineering design: principles, practice and economics of plant and process design. Elsevier.
- Utterback, J. 1994. Mastering the dynamics of innovation: how companies can seize opportunities in the face of technological change. The University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.
- VKG. 2015. Financial statement. The 2015 yearbook. <http://www.vkg.ee/aastaraamat2015/index-en.html>
- Wiśniewski, B., Czernański, E., Drożdziejcki, S., Matczak, M., and Spangenberg, E. 2014. Sulphur Regulation–technology solutions and economic consequences for the Baltic Sea Region shipping market.
- Yauch, C.A., 2011. Measuring agility as a performance outcome. *Journal of Manufacturing Technology Management*, 22(3), 384-404.
- Yin, R. K. 2009. Case study research: Design and methods (4th Ed.). Thousand Oaks, CA: Sage.

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## NEGATIVE SCREENING AND SUSTAINABLE PORTFOLIO DIVERSIFICATION

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**Abstract.** A critical issue for socially responsible investors is the selection of the potential companies to invest in. For retail investors, the easiest and more intuitive option is to apply a negative screening approach to avoid investing in companies with bad reputation. In this line, companies involved in scandals regarding irresponsible activities which have become notorious in the mass media will be excluded from the potential companies. Implementing this process in a consistent and objectivity way is not an easy task, especially with worldwide portfolios. Nevertheless, there already exist complex databases which offer sensitive information to investors. This paper describes one of these databases. Furthermore, the problems of implementing such a negative screening methodology are presented, which are mainly related with the proper diversification of the resulting investment portfolios.

**Keywords:** negative screening; bad reputation; negative media stories; ESG; controversies; sustainability; social corporate responsibility

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**JEL Classifications:** G15, Q56

## 1. Introduction

Socially responsible investment has experienced a significant growth in the last decades. As a consequence, several companies and organizations devoted to assess and rank firms' sustainability have emerged, together with new investment products such as sustainable stock indices (Kutay and Tektüfekçi, 2016). As a fact, there is not just one definition of what should be understood as sustainable behavior or socially responsible behavior, and many organizations and institutions have proposed their own definition and assessment methodology (Global Sustainable Investment Alliance, 2016).



Together with this trend, multiple academic research papers have been published dealing with sustainability issues and the ethical behaviour of companies. This problem has been approached from different perspectives and disciplines, including economy, finance, management, operational research, sociology etc. (Renneboog, et al. 2008; Berry and Yeung, 2013; Diouf et al., 2016; Dobrovolskiene et al. 2017; Jankalova and Jankal, 2017; Bikas and Saponaite, 2018, Lin, 2018; Smaliukienė and Monni, 2019).

Among the most researched topics, great attention has been devoted to the aggregation of the different criteria that are employed to measure companies' behavior including the environmental, social and governance dimensions, where different multicriteria approaches have been used (Escrig-Olmedo et al., 2017; Lamata et al., 2018). The development of rankings which consider the socially responsible performance of companies has become a hot topic in recent years, as well (Ou, 2016; García-Martínez et al., 2017; Wei et al., 2017; Cervelló-Royo, 2017). Furthermore, the relationship between financial performance and social performance has been extensively studied (Charlo et al., 2015; Achim et al., 2016; Rodríguez Fernández, 2016; Tebini et al., 2016; Charlo et al., 2017; Macikova, 2018; Simiunescu, 2018; Zhao, 2018).

Regarding investment portfolio management, research has focused on topics such as the selection of sustainable companies to be included in the portfolio using multicriteria approaches (Ballesterio et al., 2012; Gonzalez et al., 2014; Mendez Rodríguez et al., 2015; García-Melón, 2016; Calvo, 2016) and the performance obtained by socially responsible investment funds (Renneboog et al., 2011; Slapikaite y Rima, 2013; Bertrand, 2014; Lean et al., 2015; Gómez-Bezares, 2016; Reddy et al., 2017).

Defining socially responsible or ethical behavior of companies remains a controversial matter (Silvestre et al., 2016). That is, to list which actions must or must not perform firms in order to be declared as socially responsible companies. This is a key concern, as this definition will significantly impact any subsequent analysis (Benson et al., 2006; Lesser et al., 2016; Nainggolan et al., 2016; Trinks y Scholtens, 2017). This issue has raised conceptual problems, as well, and some studies sometimes use concepts such as socially responsible, ethical or sustainable as synonyms, while other studies do not consider them equivalent.

Different definitions used to refer to sustainable behaviour and different methodologies to quantify sustainable performance of companies by a plethora of firms engaged in the identification and selection of socially responsible and sustainable companies can easily lead to misunderstandings. Among those, one of the most striking cases appears when the retail investor realizes that a company which is carrying out irresponsible activities in her/his view, is still included in a ranking for socially responsible firms and is a component of a sustainable stock index. In fact, this is not an uncommon situation. As a result, companies undertaking clearly unethical, irresponsible and unsustainable activities are usually included in the portfolio of socially responsible, sustainable or ethical investment funds. Some studies show that many companies which are defined as ethical or socially responsible or sustainable would not be classified as such, if simple negative screening criteria are applied (Schwartz 2003, Hellsten, 2006; Espinós-Vaño, 2016). This situation would easily explain the surprisingly high correlation between sustainable stock indices and their conventional benchmarks (Espinós-Vaño et al., 2018), as the components of the sustainable indices and those of the benchmarks are almost the same, which is also remarkable.

The above described situation makes many researchers wonder what is wrong in the company selection process undertaken by specialized corporations and organizations that assess firms' sustainability. How is it possible that companies involved in scandals for their irresponsible or even illegal activities make it through the selection process and become part of stock sustainability indices or get good positions in sustainability rankings. (Chatterji et al., 2009; Windpolh, 2011; Baccaro y Mele, 2011).



One option to avoid this outcome is to introduce a negative screening step in the selection process. This screening would automatically prevent companies with an irresponsible activities' record to be included in a sustainability ranking or sustainable stock index. If this option is chosen, the next problem is to clearly define and identify irresponsible activities by corporations. That is, what activities automatically make a firm receive the label of "irresponsible" or "unsustainable" company. Furthermore, a database should be created to collect all the required information about the companies, including negative news in the media. If the aim is to elaborate a sustainable stock index, the database should embrace all public companies.

At present, some databases are available which contain such information. Prestigious information companies as Thomson Reuters already undertake this kind of data collection and classify and assess all negative news, which are the so-called controversies, about the main global public companies worldwide (Thomson Reuters, 2018).

The aim of this research paper is to analyse the Eikon database by Thomson Reuters in order to answer different questions regarding the sustainable behavior of the most influential companies in the world, those which are components of most conventional and sustainable stock indices. In this line, it is interesting to know in what kind of controversies or negative activities the biggest companies in the globe are involved, how the number of controversies has evolved in recent years, how the different industry sectors are affected etc. It is necessary to answer all these questions in order to know the impact a negative screening strategy would have on the diversification capacity of sustainable investing portfolios.

The research is structured as follows. First, the controversies database included in the ESG Scores module in the Thomson Reuters Eikon database is described. Then, controversies are analysed. Special attention is devoted to the impact a negative screening methodology would have on the diversification ability of sustainable portfolios, if those companies included in the controversies database would become illegible. Finally, the conclusions of the research are listed.

## **2. Controversies in the Thomson Reuters ESG Scores database**

The Eikon database by Thomson Reuters has got a specific module to assess companies' behaviour in terms of environmental, social and governance performance. In this assessment, public available information from the companies is employed, that is, companies are the ones to provide this ESG information. Nevertheless, in order to avoid the possible positive bias towards good behaviour, the assessment is completed incorporating negative news and scandals related to the companies from various news agencies, mainly Reuters.

To this end, negative news, which are the so-called controversies, are collected. At present, more than 7,000 corporations are monitored, which are spread throughout the world: more than 2,900 are located in Northamerica, 250 in Latinamerica, more than 1,400 in Europe, more than 260 in Middle East and Africa, more tha 550 in Oceania and more than 1.160 in Asia. Assessed companies are the components of the mian stock indices in the globe and in the different regios, such as SMI, DAX, CAC 40, FTSE 100, FTSE 250, S&P 500, S&P ASX 300, S&P NZX 50, NASDAQ 100, DJ STOXX, MSCI World, MSCI Emerging markets and Russell 1000. Although it is not explicitly specified, it can be assumed that the more than 7,000 corporations under assessment are not always the same, but the particular companies for which information is collected vary regarding their inclusion or exclusion from the above-mentioned indices. Nevertheless, most of the companies will remain in the group throughout the years, as companies' rotation in these indices is not very high.

In short, it is possible to state that the analysis embrasses the major public companies in the world in terms of market capitalization.

The database is feeded with the negative new and scandals which affect those over 7.000 companies. Of course, the impact of a negative event can last for many years, as there are new developments related to the negative event, such as fines, law suits or legislation disputes.

There are more than 150 analysts in charge of analysing the information included in the database. Nevertheless, the question is whether there is a bias towards the English language. If this is the case, analysts would study those company news and reports in English more carefully and accurately than similar stories in other languages. As a result, companies operating in English-speaking countries would be subject to a tighter scrutiny than the rest of corporations.

The different socially irresponsible or illegal actions carried out by companies are classified under 24 measures, which are grouped in 7 categories which embrace all the ESG scope (environment, social, governance):

-Environment:

A. Environnement:

1. Environment

-Social:

B. Community:

2. Anti-competition

3. Business ethics

4. Intellectual property

5. Public health

6. Tax fraud

7. Bribery, corruption, fraud

C. Workforce:

8. Wages and working conditions

9. Diversity and opportunity

10. Employee health and safety

D. Human rights

11. Human rights

12. Child labor

13. Freedom of association

E. Product responsibility

14. Customer health and safety

15. Responsible R&D

16. Privacy

17. Responsible marketing

18. Product access

19. Consumer complaints

- Governance

F. Management

20. Management compensation

21. Executive compensation

G. Shareholders

22. Shareholder rights

23. Insider dealings

24. Accounting

By means of the previous 24 measures those irresponsible activities are specified, which are included in the controversies' database. Furthermore, it must be stressed that so far no weighting has been done regarding the different measures, categories, or ESG scopes.

When a negative screening methodology is applied, the decision maker has to consider whether all or only a subset of controversial activities are considered in the companies' selection process. That is, it could be defined that a company with a tax fraud record can still be defined as sustainable or ethic and therefore can be included in the investment portfolio. Moreover, the news could be explicitly analysed and weighted. For example, it may be defined that avoiding paying taxes taking advantage of legal gaps is not equivalent to avoiding taxation against the laws.

In any case, the Eikon database by Thomson Reuters offers a privileged image of the irresponsible actions undertaken by major public companies around the globe. For this reason, it is an excellent tool to analyse the problems that arise when the companies in the sustainable investment portfolio are selected implementing a negative screening approach, which prevents companies involved in scandals and negative news to be included in the portfolio.

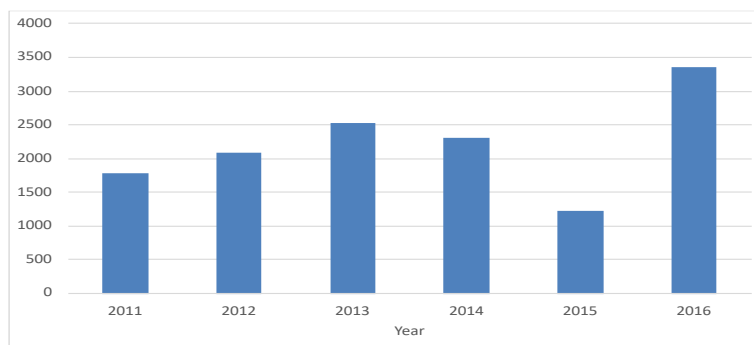
### 3. Analysis of the irresponsible activities by global public companies

This research paper analyses controversies which occurred in the years 2011 to 2016.

Out of the 7,000 firms which are yearly assessed, in the studied period a total of 1,852 corporations have been involved in controversies. Those companies have led to 13,311 controversies. This means that almost 14% of the assessed corporations have performed some irresponsible activity, as defined above.

In any case, if we regard the data from a positive perspective, they are revealing that among the biggest public companies worldwide, more than 85% did not generate any controversy in the period 2011-2016. This is an important conclusion concerning the creation of a socially responsible portfolio applying a negative screening approach. In fact, if the percentage of companies involved in controversial activities is too high, it would be very difficult to obtain a properly diversified sustainable portfolio.

Figure 1 shows the development of total controversies during the analysed period. Surprisingly, in the period from 2011 to 2016, the number of controversies has increased, especially in the last year. This trend is the opposite to what might be expected, in a time when most global companies proudly announce their commitment with sustainability and socially responsible activities.

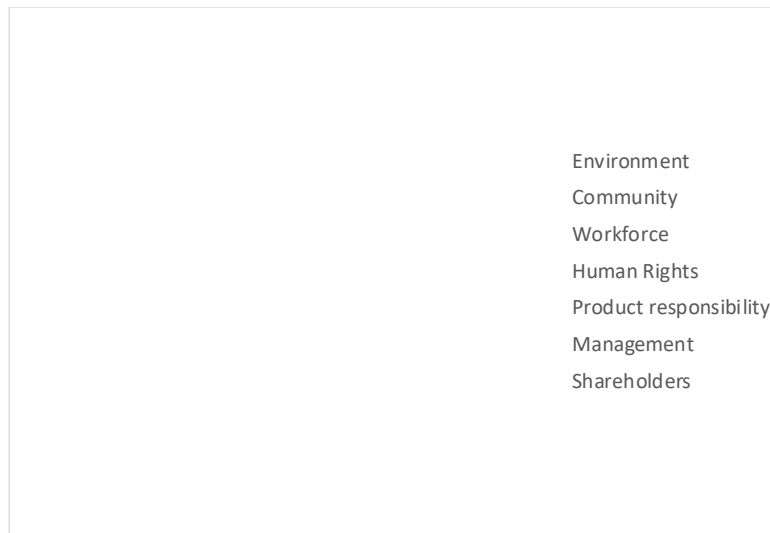


**Fig. 1.** Total Controversies 2011-2016

*Source:* The authors based on data by Eikon Thomson Reuters

It is possible that, in the sight of retail investors, not all kinds of controversies have the same relevance, and companies involved in some controversies' categories should specially be avoided, while other controversies are not perceived as too severe. For this reason, it is necessary to study the relative appearance of every category.

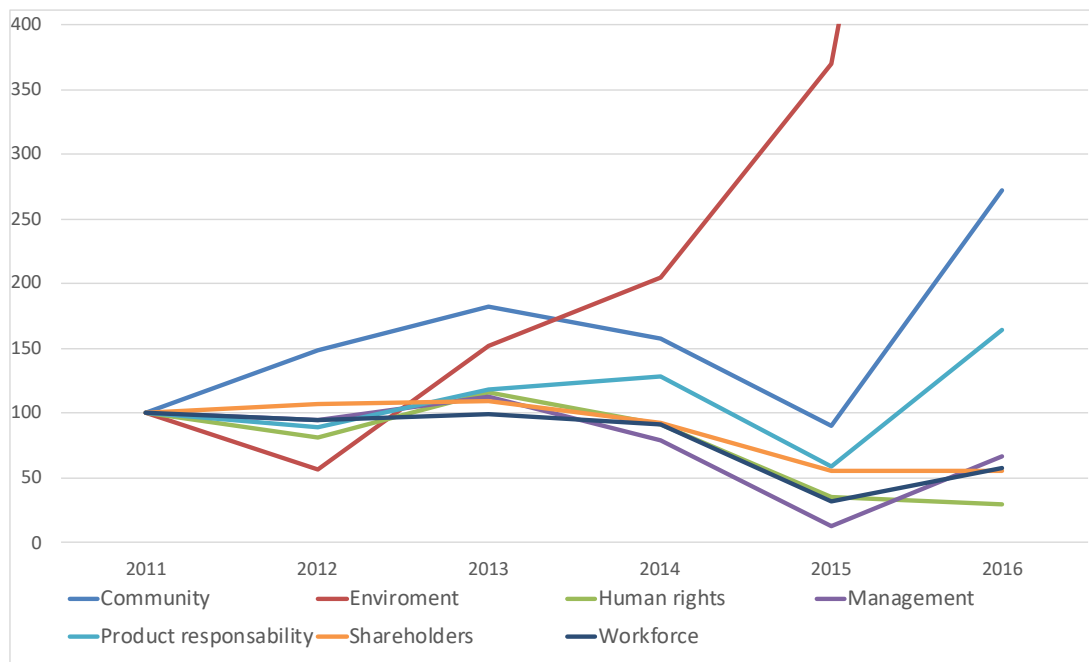
As Figure 2 shows, the category including the most controversies is "community". Those controversies are related with activities such as corruption, tax fraud or public health. Almost two thirds of all controversies are in this category. For this reason, a negative screening approach which excludes companies with controversies in the community category will see sharply decline the univers of eligible companies to include in the sustainable portfolio. On the opposite, it is easy to consider other categories, such as human rights, management, environment or shareholders. In principle, the use of these filters will scarcely affect the universe of eligible companies. Nevertheless, the use of these negative screening criteria may have an influence on the diversification ability of the portfolio, if the companies with controversial activities in one of these categories represent a high percentage of all companies within a region or an industry.



**Fig. 2.** Relative weight of each controversy category in the period 2011-2016

*Source:* The authors based on data by Eikon Thomson Reuters

Furthermore, it is important to analyse if the evolution presented in figure 1 is the same for all controversy categories or, on the contrary, the evolution has not been homogeneous. Down below, figure 3 shows this analysis for the 7 ESG categories.



**Fig. 3.** Relative weight of each controversy category in the period 2011-2016

*Source:* The authors based on data by Eikon Thomson Reuters

It can be clearly observed how the evolution of the number of controversies has not been homogeneous along all categories. Actually, environment controversies have experienced a dramatic increase since 2012. In fact, environment controversies in year 2016 cannot be presented in the figure as controversies in this category multiply by 10 in this period.

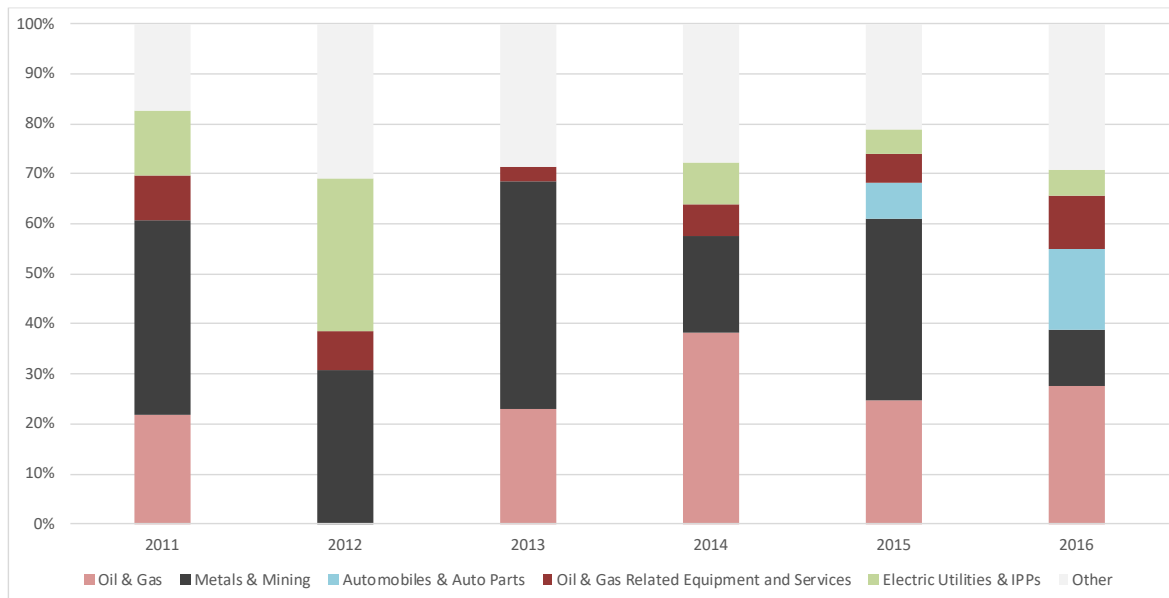
The number of controversies in the other categories have a more homogeneous evolution. There is a decrease between 2011 and 2015 followed by a sharp increase in 2016. The category of “human rights” is the only exception and continued the downward trend in 2016. The small number of controversies in this category is remarkable, as well, being just 11 in the year 2016. Controversies in this category can heavily damage a company’s reputation and image, and it is logical that corporations try to avoid them, especially those in more developed economies.

The dramatic change in 2016 makes us wonder whether the rise in controversies is actually due to an increase of irresponsible activities by companies that year, or to a change in the methodology employed by Eikon to track companies’ behavior and assess it.

The considerations above reveal a new problem faced when implementing a negative screening approach in the construction of a sustainable investment portfolio. The new problem is the high fluctuations that could be experienced in the components of the portfolio. In fact, it is important to keep in mind that the number of companies that can be implied in scandals and controversies can significantly vary in a short period of time. Therefore, it is possible that the sustainable portfolio has to be suddenly and significantly restructured. Moreover, the eligible universe can be drastically be reduced, as well, damaging the diversification ability of the portfolio. In this context, it is important to define how long companies must be labelled as non-eligible once a controversy has been disclosed. Of course, this is a subjective decision, as it is to weight the diverse controversy categories differently.

Continuing with the issues linked to portfolios' diversification, it is paramount to study whether the different irresponsible activities are conducted equally by all industries, or whether some industries are more likely to perform this kind of activities. Figures 6 to 12 show the relative weight of the 5 industries with more controversies in each of the categories during the period 2011 to 2016. The 7 categories analysed are those already mentioned: Environment, community, workforce, human rights, product responsibility, management and shareholders. As a properly diversified investment portfolio must include companies in different industries, it is necessary to analyse whether there are industries with many companies which are often involved in controversies, so that it may be more difficult to find eligible firms in these industries.

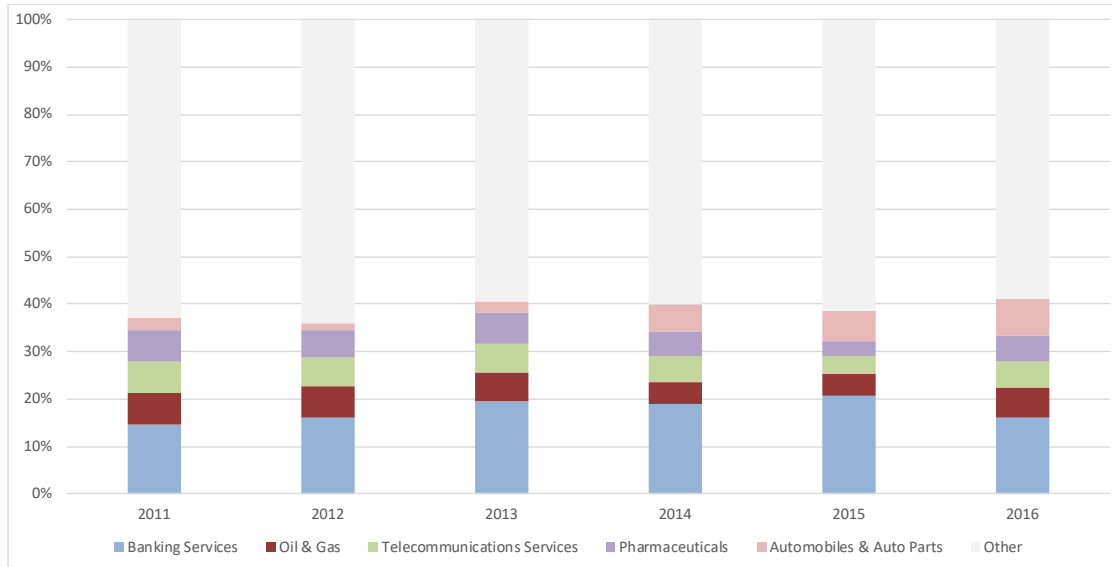
Figure 4 shows that the 5 industries with the most controversies (automobiles and autoparts; electric utilities and IPPs, metals and mining, oil and gas, oil and gas related equipment and services) account, over the 2011-2016 period, for more than 70% of the environmental controversies. The automobiles and autoparts industry arises the year 2016, probably as the scandal regarding emissions from diesel engines was uncovered.



**Fig. 4.** Evolution of the controversies of the 5 most controversial industries over total controversies. Environment

*Source:* The authors based on data by Eikon Thomson Reuters

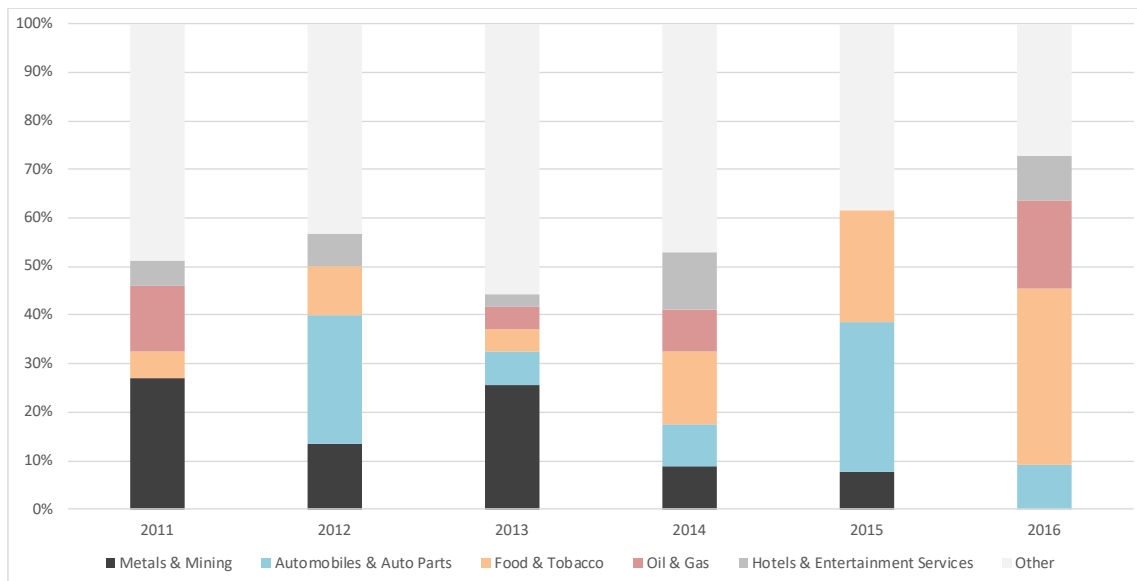
The 5 industry sectors with more controversies in the community category are automobiles and auto parts, banking services, oil and gas, pharmaceuticals y telecommunications services. Every year these industries have accumulated between 35% and 40% of all controversies in this category. The most irresponsible industry regarding community activities is banking, as figura 5 below shows.



**Fig. 5.** Evolution of the controversies of the 5 most controversial industries over total controversies. Community

*Source:* The authors based on data by Eikon Thomson Reuters

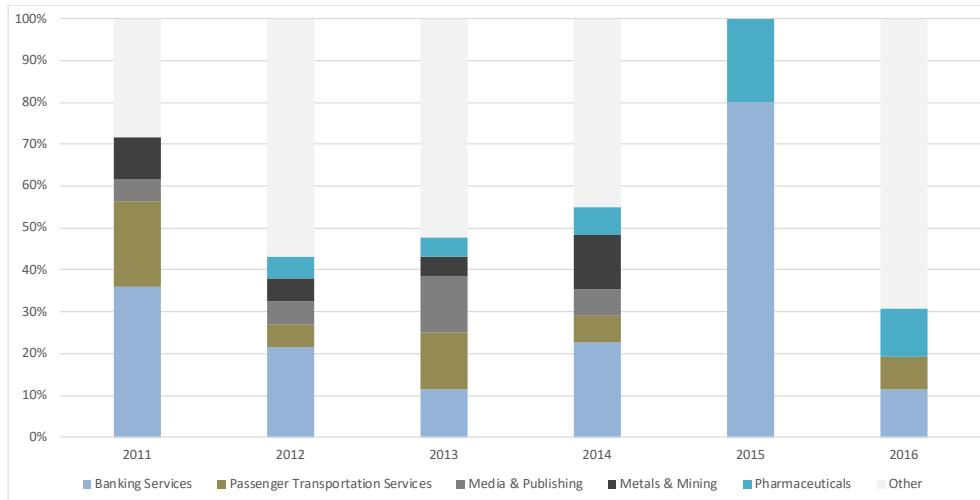
Human rights category is the one with the less controversies in the period from 2011 to 2016. As can be observed in figure 6, all controversies are carried out by a few industries. Actually, in the year 2016 just 4 industries (automobiles and auto parts, food and tobacco, oil and gas, hotels and entertainment services) are responsible for more than 70% of the controversies.



**Fig. 6.** Evolution of the controversies of the 5 most controversial industries over total controversies. Human rights

*Source:* The authors based on data by Eikon Thomson Reuters

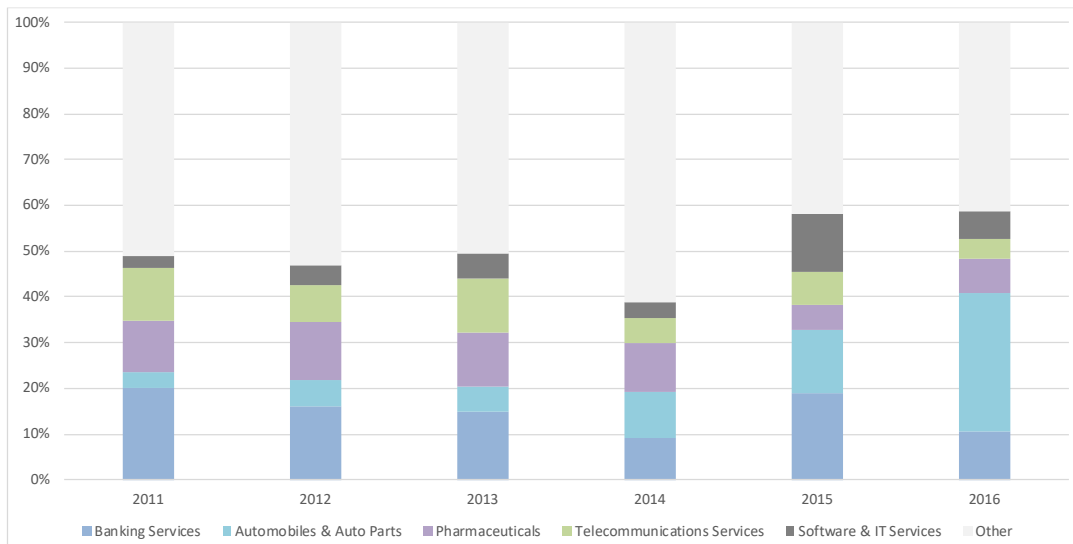
Figure 7 shows that in the case of management controversies the situation is very similar, with just a few industries generating most controversies. In the year 2015, all controversies were due to 2 industries (banking services y pharmaceuticals).



**Fig. 7.** Evolution of the controversies of the 5 most controversial industries over total controversies. Human rights

*Source:* The authors based on data by Eikon Thomson Reuters

Regarding the controversy category of product responsibility, figure 8 reveals again the high concentration degree among industries. Repeatedly, the 5 industries with more controversies in this category account for more than 50% of the irresponsible activities.

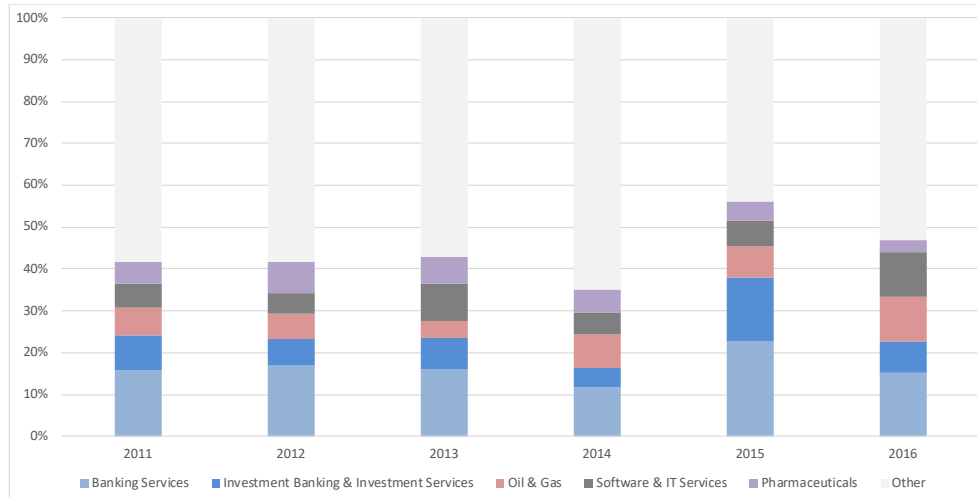


**Fig. 8.** Evolution of the controversies of the 5 most controversial industries over total controversies. Human rights

*Source:* The authors based on data by Eikon Thomson Reuters

In line with the previous figures, most controversies in the shareholder's category are caused by a few industries. Figure 9 shows that the 5 industries with more controversies in the shareholder's category account for more than 40% of all controversies in this category.

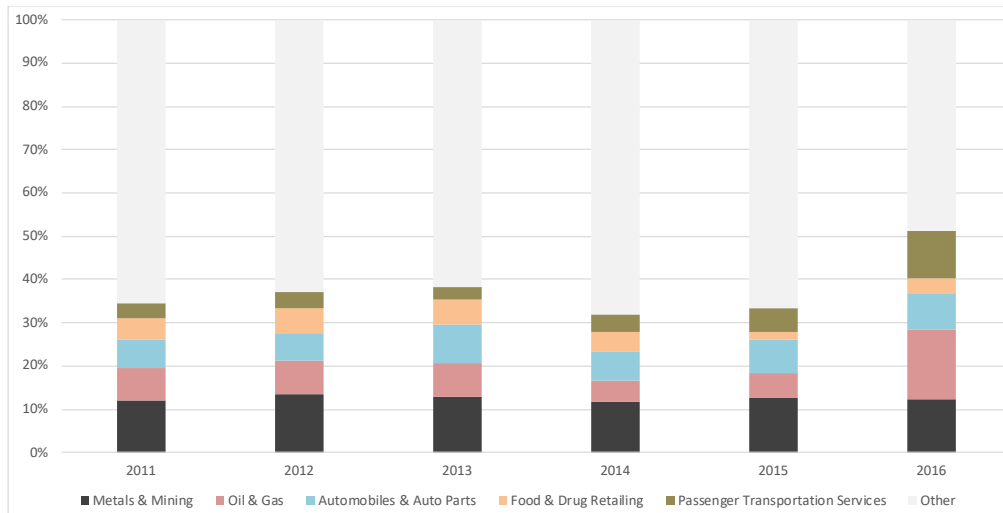




**Fig. 9.** Evolution of the controversies of the 5 most controversial industries over total controversies. Human rights

*Source:* The authors based on data by Eikon Thomson Reuters

Finally, figure 10 shows that controversies related with workforce are more common among industries. As a result, the concentration degree is not as high as in other categories. Nevertheless, in the year 2016 concentration by the 5 sectors with more controversies reached more than 50%.



**Fig. 9.** Evolution of the controversies of the 5 most controversial industries over total controversies. Human rights

*Source:* The authors based on data by Eikon Thomson Reuters

From the analysis of figures 4 to 10 it can be observed that certain industries are repeatedly included in the top 5 of controversial sectors, regarding different ESG categories. Indeed, the industries automobiles & auto parts and oil & gas are five times in the top 5, out of a total of 7 categories. These industries are followed by banking services y metals & mining, which appear four times in the top 5. Then, pharmaceutical and telecommunications services appear three times in the top 5.

This simple analysis shows that applying a negative screening methodology which avoids investing in corporations immerse in some controversial activities may impact the diversification ability of the investment

portfolio. This is the fact, even if just some ESG categories are considered. For example, for some industries it may be difficult to find enough companies eligible for investment, as could be the case of the automobiles & auto parts or the banking services industries. For these industries, it may be difficult to find enough companies that are not involved in controversies, so that the portfolio can properly be diversified.

We have already identified several problems that may appear when a negative screening methodology is applied using Eikon controversies as discriminant criterion. Together with these problems, two other issues should be considered: geographical diversification and industry diversification.

Geographical diversification is related to investing in companies located in different countries, continents or economic areas, so that the companies in the portfolio are not subject to the same economic cycle. As a result, economic crises in one country or specific area will only affect a subset of companies in the investment portfolio, not all of them. Proper geographical diversification is crucial for any portfolio.

**Table 1.** Total number of controversies per country in the period 2011-2016

Country	Number of controversies	Country	Number of controversies	Country	Number of controversies
United States of America	5531	Israel	88	Portugal	14
United Kingdom	1392	Spain	80	United Arab Emirates	13
Japan	785	Hong Kong	74	Cayman Islands	12
Germany	718	Singapore	73	Jersey	10
India	476	Denmark	53	Macao	9
Australia	432	Norway	51	Poland	9
France	405	Belgium	42	Saudi Arabia	8
Republic of Korea	399	Austria	40	Indonesia	7
Canada	384	Malaysia	38	Colombia	5
Switzerland	334	Finland	36	Egypt	5
China	223	Turkey	34	Jordan	5
Brazil	199	Luxembourg	30	Nigeria	5
Netherlands	198	Thailand	23	Peru	2
South Africa	182	Chile	21	Puerto Rico	2
Ireland	177	Greece	19	Cyprus	1
Taiwan	137	Bermuda	18	Guernsey	1
Russian Federation	124	Czechia	16	Kuwait	1
Sweden	123	Philippines	16	Kazakhstan	1
Italy	107	New Zealand	15		
Mexico	89	Hungary	14		

*Source:* The authors based on data by Eikon Thomson Reuters

It is important to keep in mind that major public companies are not homogeneously distributed around the globe. Countries have different sizes and different importance in economic terms. Therefore, it is interesting and relevant to study how controversial activities are distributed among countries. That, what is the nationality of the companies that perform irresponsible activities is.

Table 1 shows that the companies with the highest number of controversies have their headquarters in the USA, Great Britain, Japan and Germany. Out of 1,852 corporations generating controversies in the period from 2011 to 2016, these four countries host more than 50% of the irresponsible companies, which account for 63% of the total number of controversies worldwide, as can be observed in table 2.

**Table 2.** Number of companies with controversies in the five countries with more controversies

Period 2011-2016	United States of America	Great Britain	Japan	Germany
Number of companies	611	140	139	44

*Source:* The authors based on data by Eikon Thomson Reuters

It is easy to understand this fact, as those countries represent very big economies and are the host countries of most major public companies in the world. Nevertheless, it is striking the relatively high number of controversies by British firms, maybe due to the language bias mentioned above.

In fact, it is possible that, due to the language, as Thomson Reuters is an American company, more attention is devoted to those firms which have some link to English-speaking countries. In this line, companies from English-speaking countries or operating in English-speaking countries will be more accurately monitored, as their irresponsible activities will be published by English-speaking media.

In any case, table 2 shows that the number of companies illegible for the sustainable portfolio may be very high for some specific countries, as Great Britain and Germany. In fact, the number of major public companies in those countries is not as high as in the USA. The problem is especially important if industry segmentation is performed in order to better diversify the portfolio. Once more, the diversification issue is highlighted, when creating a unsustainable investment portfolio applying negative screening criteria.

This issue appears again when the number of controversies in each industry is analysed. Table 3 shows this information. At a glance, it can be observed that just a few industries are responsible for the most controversies. That is corporate social irresponsibility is concentrated in some few industries. In this sense, 33% of all controversies are generated by 4 industries: banking services, automobiles and auto parts, oil and gas, and pharmaceuticals.

**Table 3.** Number of controversies in each industry in the period 2011-2016

Industry	Number of controversies	Industry	Number of controversies
Banking Services	1891	Professional & Commercial Services	159
Automobiles & Auto Parts	903	Multiline Utilities	156
Oil & Gas	814	Healthcare Equipment & Supplies	151
Pharmaceuticals	781	Beverages	139
Telecommunications Services	680	Coal	101
Metals & Mining	658	Communications & Networking	85
Software & IT Services	541	Semiconductors & Semiconductor Equipment	85
Computers, Phones & Household Electronics	425	Construction Materials	77
Investment Banking & Investment Services	422	Electronic Equipment & Parts	72

Passenger Transportation Services	376	Textiles & Apparel	60
Food & Drug Retailing	374	Real Estate Operations	58
Food & Tobacco	352	Household Goods	52
Hotels & Entertainment Services	325	Diversified Industrial Goods Wholesalers	42
Insurance	299	Leisure Products	42
Freight & Logistics Services	293	Collective Investments	36
Media & Publishing	288	Homebuilding & Construction Supplies	36
Electric Utilities & IPPs	263	Residential & Commercial REITs	34
Machinery, Tools, Heavy Vehicles, Trains & Ships	258	Containers & Packaging	33
Personal & Household Products & Services	212	Office Equipment	30
Chemicals	209	Transport Infrastructure	24
Construction & Engineering	208	Natural Gas Utilities	22
Aerospace & Defense	206	Biotechnology & Medical Research	20
Industrial Conglomerates	206	Water & Related Utilities	20
Diversified Retail	200	Paper & Forest Products	17
Oil & Gas Related Equipment and Services	196	Investment Holding Companies	11
Specialty Retailers	182	Renewable Energy	8
Healthcare Providers & Services	172	Uranium	7

Source: The authors based on data by Eikon Thomson Reuters

Table 4 shows the number of irresponsible companies in those industries which present the highest number of controversies. It becomes obvious that diversifying a socially responsible investment portfolio is not an easy task. In fact, a high number of companies in some industries would be ineligible, so proper diversification in those industries is not actually possible.

**Table 4.** Number of irresponsible companies in the 15 most irresponsible industries in the period 2011-2016

Industry	Irresponsible companies
Banking Services	162
Metals & Mining	118
Oil & Gas	97
Telecommunications Services	84
Food & Tobacco	78
Machinery, Tools, Heavy Vehicles, Trains & Ships	78
Software & IT Services	64
Automobiles & Auto Parts	59
Pharmaceuticals	58
Electric Utilities & IPPs	56
Chemicals	55
Insurance	55

Hotels & Entertainment Services	53
Investment Banking & Investment Services	53
Professional & Commercial Services	53

*Source:* The authors based on data by Eikon Thomson Reuters

Furthermore, it is important to know which companies have performed the most irresponsible activities or are involved in the most severe scandals regarding sustainable performance. Knowing the names of the specific companies, it is easier to get an intuition of the diversification problem by the sustainable portfolio, as we get to know which companies are illegible.

Table 5 lists the 34 companies which have gathered the most controversies in the period under study. This 34 firms are responsible for 21% of all controversial activities. That is, those are companies that clearly should not be included in any investment portfolio claiming to be sustainable, ethical or socially responsible, at least as these concepts are understood by retail investors.

Table 5 shows that, if the companies with the most controversies are illegible (50 or more controversies in 6 years), the sustainable portfolio will not be able to invest in many of the major companies worldwide in terms of capitalization. That is, even if the negative screening policy is limited to prevent those 34 companies which are the most irresponsible worldwide to become components of the portfolio, severe diversification problems may arise. In fact, the portfolio had to avoid investing in many firms included in the main stock indices in the world.

**Table 5.** Number controversies by the most irresponsible companies in the period 2011-2016

Company	Industry	Number of controversies
Volkswagen AG	Automobiles & Auto Parts	157
Bank of America Corporation	Banking Services	156
JPMorgan Chase & Co	Banking Services	151
Alphabet Inc	Software & IT Services	134
Apple Inc	Computers, Phones & Household Electronics	127
Citigroup Inc	Banking Services	114
Unicredit Spa	Banking Services	109
Barclays Plc	Banking Services	108
Wells Fargo & Co	Banking Services	107
Samsung Electronics Co.,Ltd.	Computers, Phones & Household Electronics	98
Walmart Inc	Food & Drug Retailing	91
Hsbc Holdings Plc	Banking Services	86
Royal Dutch Shell Plc	Oil & Gas	81
Royal Bank of Scotland Group	Banking Services	77
Johnson & Johnson	Pharmaceuticals	75
General Motors Company	Automobiles & Auto Parts	71
Bp Plc	Professional & Commercial Services	69
At&T Inc	Telecommunications Services	67

Chevron Corporation	Oil & Gas	67
Ubs Group AG	Investment Banking & Investment Services	65
Credit Suisse Group AG	Banking Services	65
Morgan Stanley	Investment Banking & Investment Services	63
Goldman Sachs Group Inc	Investment Banking & Investment Services	62
Petroleo Brasileiro S.A.	Oil & Gas	61
Fiat Chrysler Automobiles N.V.	Automobiles & Auto Parts	60
Pfizer Inc	Pharmaceuticals	57
Heidelbergcement AG	Metals & Mining	56
Toyota Motor Corporation	Automobiles & Auto Parts	55
Ford Motor Co	Automobiles & Auto Parts	55
Tesco Plc	Food & Drug Retailing	53
McDonald's Corporation	Hotels & Entertainment Services	52
Glaxosmithkline Plc	Pharmaceuticals	51
Exxon Mobil Corp	Oil & Gas	50
Daimler AG	Automobiles & Auto Parts	50

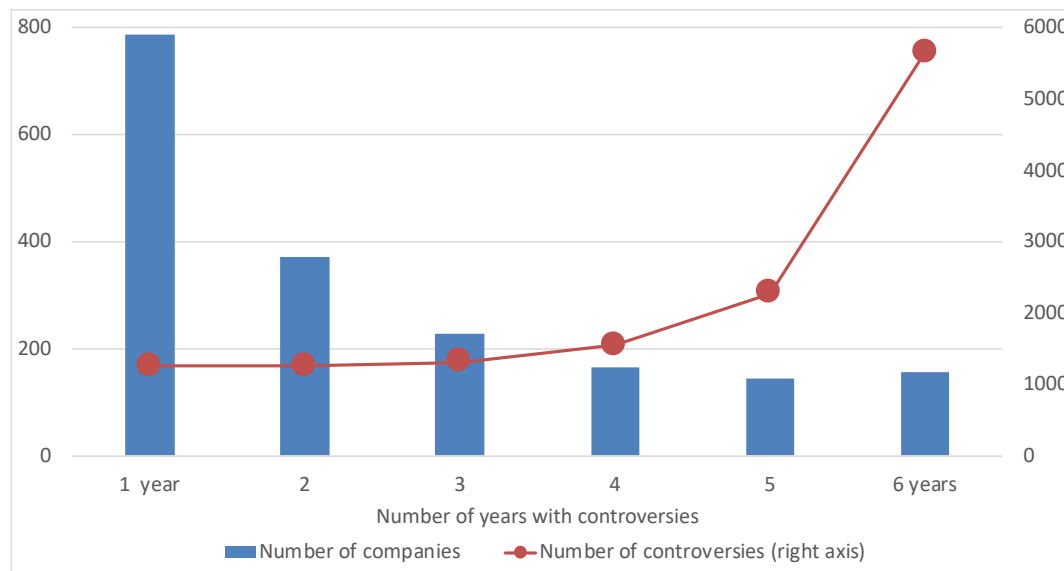
*Source:* The authors based on data by Eikon Thomson Reuters

All companies in table 5 have performed irresponsible activities each of the 6 years under assessment, but Volkswagen AG, which has been subject to controversies 5 years.

Regarding the diversification issue studied throughout this paper, it is evident that diversification in the automobiles & auto parts industry would be very difficult, as it would be not allowed to invest in major companies such as VW, General Motors, Chevron, Fiat Chrysler, Ford, Daimler, Honda, BMW and Hyundai. And this is already a problem when only the 34 companies are excluded worldwide, those with more than 50 controversies, including all industries.

In brief, it is surprising to conclude that most of the major public companies in the world are included in the Eikon controversies database by Thomson Reuters. It is also striking that the biggest corporations in the world, those with the most market capitalization and benefits, are the ones responsible for the most controversies, that is, are the firms performing the most irresponsible and unsustainable activities. This is especially unexpected, as all those firms publicly and repeatedly state their commitment to corporate social responsibility, environment, consumer protection etc., and their mission to make the world a better place.

It is possible to argue that these huge multinational corporations, due to their enormous size and relevance, are closer monitored than smaller and local firms, which is probably correct. Nevertheless, this fact can not be an excuse, as the impossible, and many times illegal, activities that are the origin of the controversies cannot be denied.



**Fig. 9.** Number of companies performing socially irresponsible activities different years in the period 2011-2016 and number of controversies by these companies

*Source:* The authors based on data by Eikon Thomson Reuters

Finally, it should be underlined that a relatively high number of companies are repeat offenders, as can be extracted from figure 11. In fact, more than 400 companies are linked to controversial activities in 4 or more years, out of the 6 years analyzed. Furthermore, these 400 companies are responsible for the most controversies. That is, companies performing socially irresponsible activities do not really feel the need to change and improve their behavior. It is important to stress the fact that, as explained above, all firms listed in table 5 belong to this group of 400 companies. Moreover, these corporations are usually included in the most prestigious sustainable stock indices and are defined as sustainable companies and socially responsible corporations by most analysts.

## Conclusions

Socially responsible investment has dramatically increased in the last decade and nowadays has become a significant investment style. In fact, the trend to only invest in those companies with good sustainable and social performance has attracted many investors, who care for global problems such as depletion of the ozone layer, climate change and numerous scandals regarding major companies' behaviour involved with corruption, fraud, child labor, slavery, irregular management compensations etc.

As a consequence of this new awareness to protect environment and society, retail investors wonder whether it is ethical to invest money and become co-owners of companies with poor sustainable performance and carrying out irresponsible and even illegal activities. To cover this new request by retail investors and attract potential clients, the financial industry has rapidly created new investment products like sustainable stock indices or ethical investment funds. These products are supposed to undertake a thorough selection of the companies included in the portfolios in terms of both return and corporate social responsibility, so that socially irresponsible firms are excluded. Nevertheless, the best-in-class approach which is typically employed in the selection process does not guarantee that firms with a reprehensible behaviour are excluded from the portfolio. The reason is that this approach does not erase those firms from the eligible universe of companies, but selects the less-irresponsible firms to be included in the portfolio employing sophisticated, multivariate and opaque methodologies. As a

result, poorly performing companies in terms of corporate social responsibility can become parts of the investment portfolio, while the diversification ability of the portfolio is preserved.

This research paper analyses the implications of applying the negative screening approach to identify those companies which should be automatically excluded from socially responsible, sustainable or ethical investment portfolios. This screening methodology does in fact avoid the inclusion of firms which have been involved in damaging activities against the environment or the society in the eligible universe of companies. In order to study whether the negative screening option is actually feasible, the companies' controversies included in the ESG Scores in the Eikon database by Thomson Reuters are analysed. This database collects negative news published worldwide about the 7,000 major public companies in the world, which are the so-called controversies.

The analysis clearly shows how difficult it is to implement the negative screening selection methodology to build a sustainable investment portfolio. In fact, this portfolio could not properly be diversified, not in geographical terms, nor regarding industry sectors. Furthermore, most major public companies in the world, in all industries, would be excluded from the portfolio, as they have been involved in diverse controversies during the period analysed, from 2011 to 2016. This is, obviously, an important drawback for a global investment portfolio.

These results reveal that it is actually not feasible to apply negative screening to select the companies in a sustainable, socially responsible or ethical portfolio. This is probably an important reason why most sustainable investment products currently apply the best-in-class methodology, which makes it possible to quite openly invest in companies involved in scandals due to their irresponsible behaviour. Nevertheless, the use of the best-in-class screening approach is probably misleading retail investors, who may believe that a so-called sustainable, ethical or socially responsible investment fund would never invest in companies performing activities which are clearly against the environment, the customers or the employees. This strategy by investment companies to mislead potential customers should come as no surprise. In fact, the financial industry is the industry collecting the most controversies in the category of community, which includes responsible marketing and customer complaints controversies. If it is not feasible to generate efficient investment portfolios for technical reasons, the ethical solution is not to change the simple negative screening methodology for a new one, more complex and less transparent. Especially, when the new approach makes it possible for clearly irresponsible companies to become a component of the ethical portfolio and be identified as sustainable and socially responsible forms. The ethical solution would be to recognize that, given the fact that most of the major public companies in the world are not behaving in a sustainable and socially responsible way, it is not feasible to generate efficient sustainable portfolios that are properly diversified just including responsible companies.

## References

- Achim, M.; Borlea, S.; & Mare, C. 2016. Corporate governance and business performance: Evidence for the Romanian economy, *Journal of Business Economics and Management* 17(3): 458-474. <http://dx.doi.org/10.3846/16111699.2013.834841>
- Baccaro, L.; & Mele, V. 2011. For lack of anything better? International organizations and global corporate codes, *Public Administration* 89: 451-470. <http://dx.doi.org/10.1111/j.1467-9299.2011.01918.x>
- Ballester, E.; Bravo, M.; Pérez-Gladish, B.; Arenas-Parra, M.; & Plá-Santamaría, D. 2012. Socially responsible investment: A multicriteria approach to portfolio selection combining ethical and financial objectives, *European Journal of Operational Research* 216 (2): 487-494. <http://dx.doi.org/10.1016/j.ejor.2011.07.011>
- Benson, K.L.; Brailsford, T.J.; & Humphrey, J.E. 2006. Do socially responsible fund managers really invest differently? *Journal of Business Ethics* 65: 337-357. <http://dx.doi.org/10.1007/s10551-006-0003-8>
- Berry, R.H.; & Yeung, F. 2013. Are investors willing to sacrifice cash for morality? *Journal of Business Ethics* 117(3): 477-492. <http://dx.doi.org/10.1007/s10551-012-1529-6>



- Bertrand, P.; & Lapointe, V. 2014. How performance of risk-based strategies is modified by socially responsible investment universe? *International Review of Financial Analysis* 38: 175- 190. <http://dx.doi.org/10.1016/j.irfa.2014.11.009>
- Calvo, C.; Ivorra, C.; & Liern, V. 2016. Fuzzy portfolio selection with non-financial goals: exploring the efficient frontier, *Annals of Operations Research* 245(1-2): 31-46. <http://dx.doi.org/10.1007/s10479-014-1561-2>
- Cervelló-Royo, R.; Guijarro, F.; & Martínez-Gómez, V. 2017. Social performance considered within the global performance of microfinance institutions: a new approach, *Operational Research*: 1-19. <http://dx.doi.org/10.1007/s12351-017-0360-3>
- Charlo, M.; Moya, I.; & Muñoz, A. 2017. Financial performance of socially responsible firms: The short- and long-term impact, *Sustainability* 9(9): 1-15. <http://dx.doi.org/10.3390/su9091622>
- Charlo, M.J.; Moya, I.; & Muñoz, A.M. 2015. Sustainable development and corporate financial performance: A study based on the FTSE4Good IBEX index, *Business Strategy and the Environment* 24: 277-288. <http://dx.doi.org/10.1002/bse.1824>
- Chatterji, A.K.; Levine, D.I.; & Toffel, M.W. 2009. How well do social ratings actually measure corporate social responsibility? *Journal of Economics & Management Strategy* 18(1): 125-169.
- Diouf, D.; Hebb, T.; & Touré, E. 2016. Exploring factors that influence social retail investors' decisions: Evidence from Desjardins Fund, *Journal of Business Ethics* 134(1): 45-67. <http://dx.doi.org/10.1007/s10551-014-2307-4>
- Dobrovolskiene, M.; Tvaronaviciene, M.; Tamosiuniene, R. (2017). Tackling projects on sustainability: A Lithuanian case study, *Entrepreneurship and Sustainability Issues* 4(4): 477-488. [http://dx.doi.org/10.9770/jesi.2017.4.4\(6\)](http://dx.doi.org/10.9770/jesi.2017.4.4(6))
- Escrig-Olmedo, E.; Muñoz-Torres M.J.; Fernández-Izquierdo, M.A.; & Rivera-Lirio, J.M. 2017. Measuring corporate environmental performance: A methodology for sustainable development, *Business Strategy and the Environment* 26(2): 142-162. <http://dx.doi.org/10.1002/bse.1904>
- Espinós- Vañó, M.D.; & García, F. 2018. Irresponsible behavior of Spanish FTSE4Good IBEX companies based on NGO reports. *10<sup>th</sup> International Scientific Conference "Business and Management 2018"*. May 3-4, Vilnius, Lithuania. VGTU Press.
- Espinós- Vañó, M.D.; García, F.; & Oliver, J. 2018. The ethical index Ftse4Good Ibex as an alternative for passive portfolio strategies in Spain, *Finance, Markets and Valuation* 4(1): 117-129.
- Espinós-Vañó, M.D. 2016. Socially responsible investment in Spain: Ethics and transparency, *Finance, Markets and Valuation* 2(2): 73-89.
- García-Martínez. G.; Guijarro, F.; & Poyatos, J. 2017. Measuring the social responsibility of European companies: A goal programming approach, *International Transactions in Operational Research*: 1-22. <http://dx.doi.org/10.1111/itor.12438>
- García-Melón, M.; Pérez-Gladish, B.; Gómez-Navarro, T.; & Mendez-Rodriguez, P. 2016. Assessing mutual funds' corporate responsibility: a multistakeholder-AHP based methodology, *Annals of Operations Research* 244(2): 475-503. <http://dx.doi.org/10.1007/s10479-016-2132-5>
- Global Sustainable Investment Alliance. 2016. Global Sustainable Investment Review.
- Gómez-Bezares, F.; Przychodzen, W.; & Przychodzen, J. 2016. Corporate sustainability and shareholder wealth: Evidence from British companies and lessons from the crisis, *Sustainability* 8(3): 1-22. <http://dx.doi.org/10.3390/su8030276>
- González, J.M.; Ruiz, F.; Méndez-Rodríguez, P.; & Pérez Gladish, B. 2014. Interactive socially responsible portfolio selection: An application to the Spanish stock market, *INFOR: Information Systems and Operational Research* 52(3): 126-137. <http://dx.doi.org/10.3138/infor.52.3.126>
- Hellsten, S.; & Mallin, C; 2006. Are "ethical" or "socially responsible" investments socially responsible? *Journal of Business Ethics* 66: 393-406. <http://dx.doi.org/10.1007/s10551-006-0001-x>
- Jankalová, M.; & Jankal, R. 2017. The assessment of corporate social responsibility: approaches analysis, *Entrepreneurship and Sustainability Issues* 4(4): 441-459. [http://dx.doi.org/10.9770/jesi.2017.4.4\(4\)](http://dx.doi.org/10.9770/jesi.2017.4.4(4))
- Kutay, N.; & Tektüfekçi, F. 2016. A new era for sustainable development: A comparison for sustainability indices, *Journal of Accounting, Finance and Auditing Studies*, 2: 70-95.

- Lamata, M.; Liern, V.; & Pérez-Gladish, B. 2018. Doing good by doing well: a MCDM framework for evaluation corporate social responsibility attractiveness, *Annals of Operations Research* 267(1-2): 249-266. <http://dx.doi.org/10.1007/s10479-016-2271-8>
- Lean, H. H.; Ang, W. R.; & Smyth, R. 2015. Performance and performance persistence of socially responsible investment funds in Europe and North America, *North American Journal of Economics and Finance* 34: 254-266. <http://dx.doi.org/10.1016/j.najef.2015.09.011>
- Lesser, K.; Rössle, F.; & Walkshäusl, C. 2016. Socially responsible, green, faith-based investment strategies: Screening activity matters! *Finance Research Letters* 16: 171-178. <http://dx.doi.org/10.1016/j.frl.2015.11.001>
- Lin, S., & Hsu, M. 2018. Decision making by extracting soft information from CSR news report. *Technological & Economic Development of Economy* 24(4): 1344-1361. <http://dx.doi.org/10.3846/tede.2018.3121>
- Macikova, L.; Smorada, M.; Dorčák, P.; Beug, B.; & Markovič, P. 2018. Financial aspects of sustainability: An evidence from Slovak companies, *Sustainability* 10(7): 1-15. <http://dx.doi.org/10.3390/su10072274>
- Nainggolan, Y.; How, J.; & Verhoeven, P. 2016. Ethical screening and financial performance: The case of Islamic equity funds, *Journal of Business Ethics* 137(1): 83-99. <http://dx.doi.org/10.1007/s10551-014-2529-5>
- Ou, Y. 2016. Using a hybrid decision-making model to evaluate the sustainable development performance of high-tech listed companies, *Journal of Business Economics and Management* 17 (3): 331-346. <http://dx.doi.org/10.3846/16111699.2015.1110713>
- Pérez-Gladish, B.; Benson, K.; & Faff, R. 2012. Profiling socially responsible investors: Australian evidence, *Australian Journal of Management* 37(2): 189-209. <http://dx.doi.org/10.1177/0312896211429158>
- Reddy, K.; Mirza, N.; Naqvi, B.; & Fu, M. 2017. Comparative risk adjusted performance of Islamic, socially responsible and conventional funds: Evidence from United Kingdom, *Economic Modelling* 66: 233-243. <http://dx.doi.org/10.1016/j.econmod.2017.07.007>
- Renneboog, L.; Horst, J.T.; & Zhang, C. 2008. Socially responsible investments: Institutional aspects, performance and investor behavior, *Journal of Banking and Finance* 32(9): 1723-1742. <http://dx.doi.org/10.1016/j.jbankfin.2007.12.039>
- Renneboog, L.; Ter Horst, J.; & Zhang, C. 2011. Is ethical money financially Smart? Nonfinancial attributes and money flows of socially responsible investment funds, *Journal of Financial Intermediation* 20(4): 562-588. <http://dx.doi.org/10.1016/j.jfi.2010.12.003>
- Rodriguez-Fernandez, M. 2016. Social responsibility and financial performance: The role of good corporate governance, *BRQ Business Research Quarterly* 19(2): 137-151. <http://dx.doi.org/10.1016/j.brq.2015.08.001>
- Schwartz, M.S. 2003. The “ethics” of ethical investing, *Journal of Business Ethics* 43(3): 195-213. <http://dx.doi.org/10.1023/A:1022933912939>
- Simionescu, L.; & Dumitrescu, D. 2018. Empirical study towards corporate social responsibility practices and company financial performance. Evidence for companies listed on the Bucharest stock exchange, *Sustainability* 10(9): 1-21. <http://dx.doi.org/10.3390/su10093141>
- Silvestre, W.J.; Antunes, A.; & Leal Filho, W. 2016. The corporate sustainability typology: Analysing sustainability drivers and fostering sustainability at enterprises. *Technological and Economic Development of Economy* 24(2): 513-533. <http://dx.doi.org/10.3846/20294913.2016.1213199>
- Slapikaite, I.; & Tamosiuniene, R. 2013. Socially responsible mutual funds: A profitable way of investing. *Analele Stiintifice ale Universitatii Al I Cuza din Iasi - Sectiunea Stiinte Economice* 60(1): 1-13. <http://dx.doi.org/10.2478/aicue-2013-0017>
- Smaliukienė, R.; & Monni, S. 2019. A step-by-step approach to social marketing in energy transition, *Insights into Regional Development* 1(1): 19-32. [https://doi.org/10.9770/ird.2019.1.1\(2\)](https://doi.org/10.9770/ird.2019.1.1(2))
- Tebini, H.; M'Zali, B.; Lang, P.; & Perez-Gladish, B. 2016. The economic impact of environmentally responsible practices, *Corporate Social Responsibility and Environmental Management* 23: 333-344. <http://dx.doi.org/10.1002/csr.1383>
- Thomson Reuters 2018. Thomson Reuters ESG Scores.

Trinks, P.J.; & Scholtens, B. 2017. The opportunity cost of negative screening in socially responsible investing, *Journal of Business Ethics* 140(2): 193-208. <http://dx.doi.org/10.1007/s10551-015-2684-3>

Wei, F.; Lu, J.; & Kong, Y. 2017. Research on sustainability financial performance of Chinese listed companies, *Sustainability* 9 (5): 1-17. <http://dx.doi.org/10.3390/su9050723>

Windolph, S.E. 2011. Assessing corporate sustainability through ratings: challenges and their causes, *Journal of Environmental Sustainability* 1: 61-80. <http://dx.doi.org/10.14448/jes.01.0005>

Zhao, C.; Guo, Y.; Yuan, J.; Wu, M.; Li, D.; Zhou, Y.; & Kang, J. 2018. ESG and corporate financial performance: empirical evidence from China's listed power generation companies, *Sustainability* 10(8): 1-18. <http://dx.doi.org/10.3390/su10082607>

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## COMPETITIVENESS OF HORTICULTURAL PRODUCTS AS A PRECONDITION OF INDUSTRY DEVELOPMENT

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**Abstract.** Modern world globalization processes, a highly competitive environment and meeting the requirements of national interests, place new demands on the strategy of development of the horticultural industry in Ukraine, which should be aimed at increasing the competitiveness of fruit and berry products, its quality and environmental safety. Issues of competitiveness, quality and safety of agricultural products — are the most important among research of scientists, especially in developing countries. Improving the quality and safety of agricultural products is one of the main strategies for the development of agriculture in Ukraine; therefore, economic indicators are depreciated on the secondary plan: profit, profitability level, and the indicators of biological and social value of products become priority. That is why the main purpose of writing the article is to clarify and improve the indicators of assessing the competitiveness of horticultural products as a precondition for the development of the industry, its competitiveness. To achieve the research purpose the state of the industry, its competitive advantages was analyzed; an expert evaluation of the main parameters of the competitiveness of fruit and berry products was carried out, a survey was carried out by both producers and consumers of products on the importance of individual indicators in assessing the overall competitiveness of products. As a result of the conducted research, the methodology of evaluating the competitiveness of fruit and berry products with the account of biological, ecological, production and economic parameters was specified and the main technological stages of the formation of these indicators in horticulture were determined.

**Keywords:** competitiveness of products; horticulture; fruit and berry products; product quality; product safety; Ukraine

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**JEL Classifications:** E23, P32, Q12, Q18

**Additional disciplines:** ecology and environment

## **1. Introduction**

Horticulture can be considered as one of the most important branches of agricultural production in Ukraine due to the production of valuable fruit and berry products rich in vitamins and biologically active substances. The importance of horticultural products to meet the food needs of the population of Ukraine and its regions can not be overestimated, since fruits and berries are valuable and irreplaceable food products that are characterized by tread properties, which, due to the high content of pectin that extracts toxins from the body, including radioactive elements (Shestopal & Ermakov, 1998), and the branch of horticulture is an important component of the country's economic and social development. Ukraine has all the necessary conditions for growing sufficient quantity and quality of fruit and berry products, but the experts' assessment of the industry is the basis for the conclusion that Ukrainian horticulture by most indicators is not able to compete with the level of development of this industry in Europe.

Modern world globalization processes, a highly competitive environment and meeting the requirements of national interests place new demands on the development strategy of the domestic industry. In particular, the situation has changed since January 2016, with the entry into force of the Agreement on a Deep and Comprehensive Free Trade Area between Ukraine and the European Union. On the positive side — domestic producers of horticultural products have opened new opportunities for exporting products to EU countries, from the negative — insufficient competitiveness of Ukrainian fruit and berry products in the markets of Europe, both qualitative parameters and development potential, as in many European countries, horticulture — the strategic sector of the economy, which is supported by the state. In such a situation domestic producers of horticultural products were in unequal conditions with foreign producers: high standards of quality of European agricultural products, non-compliance with quality standards and control, lack of proper logistical support, imperfect Ukrainian cultivating technology and diverse horticultural products of competitors threaten the domestic market of gardening products. Alongside with this, European countries, nevertheless, are not without reason, see Ukraine as a potential competitor, because our country has potential advantages for the production of ecologic fruit and berry products and take an important place in the markets of Europe.

## **2. Literature review**

The issue of improving the competitiveness of the industry, the main strategic and innovative priorities of horticulture development are considered in the works of domestic and foreign scientists. In particular, in his research, Kondratenko (2017) focuses on the need for innovations in horticulture, through the elimination of immune-resistant varieties of fruit and berry products, the cultivation of which will allow to obtain more ecological safety horticultural products (p. 122).

Improvement of the method for assessing the competitiveness of horticultural products is devoted to a number of works by Rul'ev (2007), in particular in his monograph (p. 109), the author draws attention to the fact that the assessment of the competitiveness of pomological varieties of fruit crops is recommended to be carried out in soil-climatic zones, taking into account their natural features, which directly affects the quality and quantity of the fruit and the price of the product.

The main strategic and innovative priorities of horticultural development in Ukraine are researched in the works of Kushniruk (Kushniruk et al., 2009), where it is noted that the increase of efficiency and competitiveness of horticulture should be based on its consistent intensification, which provides deepening the specialization and concentration of the industry and transfer to the innovative and investment way of development (p. 3).



Increasing the competitiveness of domestic horticulture depends on its scientific support (Shestopal et al., 2008): “The research area should focus on the market for the latest developments, study the demand for scientific products, create such technologies that, in the conditions of the economic crisis, would meet the criteria of efficiency, were low-cost, resource-saving and environmentally safe. This necessitates the creation of innovative products in the industry in accordance with the requirements of the market for science-intensive products” (p. 126). Gutorova (2013) emphasizes that “to ensure the production of horticultural products of a guaranteed quality and to protect consumers' interests, it is necessary to improve the national system of certification and standardization of food products, planting material, as well as a system of sanitary control (covering also imported products), which should find the place of control of the timeliness and completeness of all technological operations during the production of fruits, berries and seedlings in different regions of Ukraine” (p. 139). The question of changing the market condition of horticultural products under the influence of globalization processes was considered in the works of Karpenko et al. (2016). Rul’ev (2004) notes that the economic components of the prospects for the development of industries, in particular, regarding the rational allocation and specialization of the production of certain types of products, can only be justified by the qualitative consideration of the correspondence of soils, climate and relief to the biological requirements of agricultural crops (p. 6). Given the diversity of the climate of Ukraine, Kondratenko et al. (1999) argued about the importance of zoning of horticulture and the establishment of an orchard variety of fruit and berry crops. Therefore, there was and is in the country an extremely topical problem of zonal specialization in horticulture, rational territorial placement of production of specific types of fruits and berries.

Modern researches of foreign authors, for the most part, focus on the application of innovative technologies in horticulture and their impact on the environment, ecology, society. In particular, among the foreign authors who studied the competitiveness of horticulture should be identified Pushkarik et al. (2009), studied the problems of producing high quality horticultural products in Europe as in general, and in Serbia as in particular. Scientists Van den Broek and Myet Martins focused on studying the relationship between the volume of production and export of gardening products and food security in developing countries. (Goedele Van den Broeck & Miet Maertens, 2016). Angeles Godoy-Duran et al. devote their work on the effectiveness of eco-gardening in Spain (2017). The issues of the competitiveness of Polish horticulture are considered in the works of Polish scientists, among which the following scientists should be distinguished: Jablonska, Filipiak, Gunerco. Scientists have proved the importance of constant control of costs in horticulture in order to ensure its competitiveness (Lilianna Jablonska et al., 2017). Issues of determining factors driving sustainable performance through the application of lean management practices in horticultural primary production were explored by Darian Pearcea, Manoj Dorab, Joshua Wesanaac & Xavier Gellyncka (Darian Pearcea et al., 2018). Analyzing recent publications and researches of both foreign and domestic authors, it should be noted that the interest in issues of innovative technologies of fruit and berry production, which would ensure high competitiveness of products, increased its ecological and socio-economic value of the industry should be noted. Considering the importance of horticulture as a key industry that provides food security to the country, the environmental and social component of its development, there is a need for further methodological developments and practical recommendations on improving the competitiveness of domestic horticultural products as a priority for strategic development of the industry. The key point of research should be the development of measures that ensure the high quality of horticultural products, its compliance with standards, environmental safety. So, economic indicators: profit, profitability level go down to the secondary plan. Priority is given to indicators of biological and social value of products: the biological value per unit of the spent resource and the share of labor costs in the cost of production etc. Accordingly, indicators for assessing the competitiveness of fruit and berry products need to be substantially refined.

### 3. Aim

The main purpose of the article is to clarify and improve the indicators for assessing the competitiveness of horticultural products as a prerequisite for the development of the industry.

#### 4. Data and Methods

During writing of the article we used both general science methods, and applied methods of research. In the study of economic processes, national legislation, works of domestic and foreign authors we used systematic and complex approaches, a combination of historical and logical methods.

The first part of our research is aimed at assessment of the current state of Ukrainian horticulture and its competitiveness. To study this issue we used dialectical method of cognition, induction and deduction, trend analysis, comparative analysis.

The second and the third part of the study are aimed at improvement of evaluation indicators of the competitiveness for fruit and berry products. The evaluation of the competitiveness of horticultural products was carried out through a comparative analysis using the classical theory of "Effective competition" J. Alois Shumpeter (1983), according to which effective competition is possible only in a dynamic economy, innovation. The theory of "Premises of the Corporative Strategy", Michael E. Porter (1987), has been taken into consideration, according to which any successful corporate strategy builds on a number of premises.

For evaluation the competitiveness of horticultural products we used a score assessment (methodology of the annual Global Competitiveness Report, Global Economic Forum, 2018). Biological, ecological and economic parameters of the competitiveness of a separate apple variety were determined on the basis of research by scientists-pomologists.

To justify the parameters of the competitiveness of horticultural products we used assessments of industry experts. Consumers and producers survey were carried out on the level of significance of individual parameters in the calculation of the general competitiveness of horticultural products (*Table 3*). The survey was conducted among producers and consumers of horticultural products in Podillya (Khmelnysky and Vinnytsia regions), the region that holds the largest share in the total production of fruits and berries in Ukraine. Among the producers were selected 15 main farms engaged in the cultivation of fruit and berry products, consumers — the local population (527 consumers of different age groups participated in the consumer survey). Despite the small percentage of the sample (0.02 %), we tend to consider the results of the survey as reliable, since the total share of Vinnitsa and Khmelnytsky districts in the total volume of production of fruit and berry products in Ukraine is almost 40 percent (State Statistic Service of Ukraine, 2017). The detailed information about the Respondents is presented in *Table 1*.

**Table 1.** Respondents' characteristics (consumers)

Age range	Number of respondents	Percentage (%)
15 - 25	54	10
25 - 34	125	24
35 - 44	212	40
45 - 54	136	26
55 - 64	54	10
more than 65	125	24

*Source:* The authors' own calculations based on survey of producers and consumers of horticultural products in Podillya

During the study we used data from the State Statistics Service of Ukraine for the period from 2010 to 2017; Eurostat data on the volume of organic garden production in the EU; information of organic producers in Ukraine "Organic Ukraine"; information of specialists of the branch, in particular the associations of producers of

horticultural products "Ukrsadprom"; domestic and foreign studies of scientists who studied the current state and trends of development, competitiveness of the horticultural industry.

## 5. Results

**Assessment of the current state of Ukrainian horticulture and its competitiveness.** Horticulture of Ukraine is one of the main branches of agricultural production, which provides the needs of the population in finished products, industry — processing raw materials, rural areas — workplaces.

Ukraine, which apples are one of the main crops, is ranked 12th in the world ranking, with a production volume of 3.3 million tons. The share of output of fruit and berry products in the total output of crop production was 3.22% in 2010 and 2.92% in 2016 (Table 2).

**Table 2.** Value of horticultural production in Ukraine

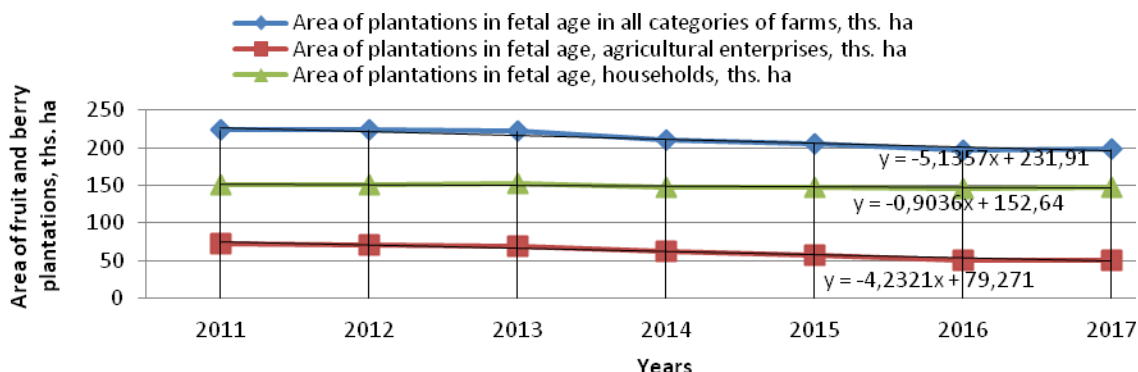
Indexes	2010	2015	2016
Gross production of fruits and berries, mln UAH	9633	18390	18262
GDP, mln UAH	1079346	1988544	2385367
<b><i>Share in GDP, %</i></b>	<b><i>0.89</i></b>	<b><i>0.92</i></b>	<b><i>0.76</i></b>
Gross output of agriculture, mln UAH	298984	532257	625585
<b><i>Share in Gross output of agriculture, %</i></b>	<b><i>3.22</i></b>	<b><i>3.45</i></b>	<b><i>2.92</i></b>

*Source:* The authors' own calculations based on data of State Statistics Service of Ukraine (2017)

Horticultural experts have proved that for the successful development of the industry, its competitiveness both must be taken into account economic and natural factors. Assessing the competitive advantages of horticulture in Ukraine by natural factors, we note that the state has sufficient advantages over European countries in terms of soil and climatic conditions, but, unfortunately, it is not fully use these advantages yet, since, in the first place, the existing constraints are the economic preconditions.

Lack of proper financing of the industry and state support, necessary logistical support and material motivation of employees; high complexity and cost of production; the discrepancy between the selling price and the production unit cost price, the unregulated market for horticultural products and the lack of scientific support of the industry led to negative trends in horticulture. According to the State Statistics Service of Ukraine (Ukrstat), for the period from 2011 to 2017 there is a gradual decrease in the area under fruit and berry plantations in the fruiting age: annually by 5.13 thousand hectares in all categories of farms, which is mainly due to the reduction of the area of plantations in agricultural enterprises, an average of 4.23 thousand hectares for the analyzed period (Graph 1).

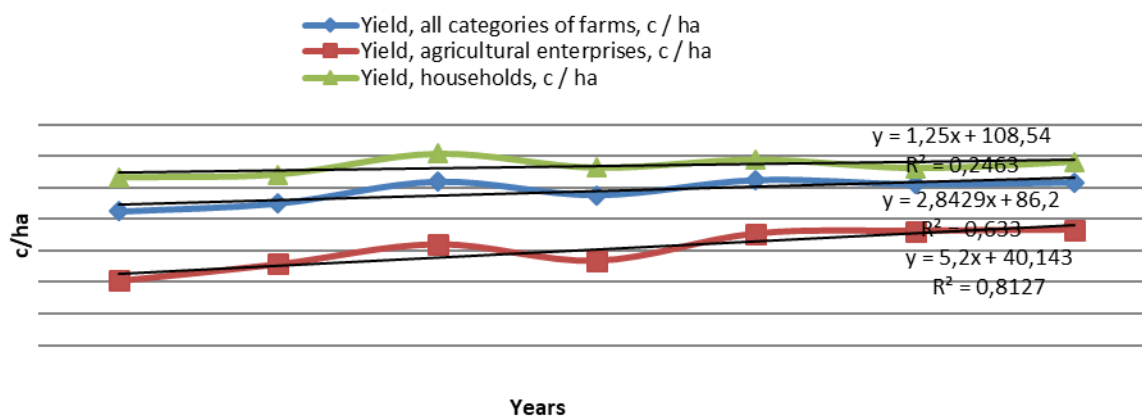




**Graph 1.** Dynamics of areas under fruit and berry plantations in Ukraine

Source: The authors' own calculations based on data of State Statistics Service of Ukraine (2017)

Together with the annual reduction of areas under fruit and berry crops, there is an increase in the yield of horticultural products, which has a positive trend: the yield of fruit and berry crops, in all categories of farms, increased by an average of 2.84 c/ha for the analyzed period. However, there is a significant variation in yield. The average yield of fruit and berry crops during 2011-2017 at agricultural enterprises is 40.1 centners per hectare, while in the households is 108.5 centners per hectare (Graph 2).



**Graph 2.** Dynamics of yield of fruit and berry plantations in Ukraine

Source: The authors' own calculations based on data of State Statistics Service of Ukraine (2017)

The unstable political, economic situation in the country and the high cost of horticultural production have led to the fact that horticulture in Ukraine is generally low-profitable. The profitability of fruit production, according to Ukrstat, in agricultural enterprises in 2016 amounted to 12%, including: in business partnerships — 11%, private — 22.3%, state — 11.7% (Ukrstat, 2016). The situation with berries is slightly better, where the average profitability in agricultural enterprises is 104 percent.

The assessment of the state of the industry also suggests that horticulture of Ukraine in recent years has been concentrated mainly in households and small farms with higher productivity and profitability. The obtained higher yields in households, compared to agricultural enterprises, indicate a better organizational and agronomic work of

managers, better technical and financial support, the use of high-yielding planting varieties, etc. Thus, one of the trends in the development of Ukrainian horticulture is the process of gradual reduction of industrial horticulture. In our opinion, this situation does not contribute to the improvement of the state of the industry, and, moreover, to increase its competitiveness, as there are factors of both economic and mental character, in particular: lack of competence in horticultural matters; insufficient material, technical, technological support; non-compliance with the production technology, resulting in deterioration of the environmental situation, the quality of the products produced, its ecologic.

**The need to increase the competitiveness of fruit and berry products.** In order to enter the foreign markets, horticultural products must meet certain quality standards, be safety and biologically valuable - only such products can take their place among competitors.

For comparison, in the European Union, today, according to Eurostat, more than 300 thousand hectares of organic gardens, half of which — in Poland, France, Italy. In addition, 24.2% of all organic farms in the EU grow fruits (Antonella De Cicco, 2016). According to a union of producers of organic products "Organic Ukraine" (2017), European companies are interested in organic horticultural products and see in Ukraine a great potential for the production of organic products. However, for today, only 15 companies that are engaged in organic production are certified in Ukraine, 7 of them specialize in the cultivation of organic apples. Thus, under organic production in Ukraine occupied 0.15% of traditional gardens.

The modern Ukrainian market is full of imported products, which creates competition for domestic. However, not all imported products are qualitative, but in such a way as to meet the requirements of standards and dietary nutrition.

Chinese scientists Yao Yuchen et al. argue that modern means of protecting crops and chemical fertilizers are so aggressive that it is not always possible to ensure the proper quality and safety of products (2013). They prove that a large number of fruits and berries in the world market have been grown and stored in a non-natural way, which means that during growing, farmers used ripening and growth boosters of fruits and berries; sellers, for their part, used chemicals for storage, such as "formaldehyde", "formalin", and so on. These chemicals are hazardous and can cause significant harm to the human body and are dangerous. That is why the issue of quality and safety of agricultural products is among the key issues in the scientific research of the world, and the quality indicators of the effectiveness of the assessment of output, in our opinion, must dominate the indicators of economic efficiency.

According to Shpichak (2010) "the quality of agricultural products is one of the most difficult categories with which humanity faces in the process of material production. The level of product quality affects the price, costs, the level of gross output of the finished product, productivity, profitability, product competitiveness, and ultimately - the health and life expectancy of a person" (p. 11). Consequently, quality plays a great role in the system for assessing the competitiveness of products. It is important to share the concept of quality and safety of food products. Food safety (CAC, 2005) — assurance that food will not cause harm to the consumer when it is prepared and/or consumed according to its intended use. Food quality (ISO, 22000:2018) — the totality of features and characteristics of a product that bear on its ability to satisfy stated or implied needs.

The system of quality and food safety management in Ukraine is mandatory for the implementation and functioning, regulated by Law of Ukraine "On Basic Principles and Requirements for Food Safety and Quality" (1998). The purpose of the Law is to facilitate the active introduction of Hazard Analysis and Critical Control Points (HACCP) at the domestic enterprises of the international system for controlling the safety and quality of food products. However, the authors of the study point out that for the implementation of the concept of HACCP in the production of horticultural products, there are certain restraining factors in the country, among which are: the concentration of production of fruit and berry products, mainly in households where it is impossible to control the production process in full ; low selling price, which does not cover additional costs for product quality.

**Improvement of evaluation indicators of the competitiveness for fruit and berry products.** Considering agricultural products, we should highlight its uniqueness, which makes it distinct among the products of the industry. Therefore, when we talk about its quality, it is important to focus not only on environmental performance but also on the biological and ecological value of cultivated produce.

In addition to the qualitative characteristics to assess the competitiveness of products includes other factors. It is known, that competitiveness is a comparative characteristic of products, which contains a comprehensive assessment of the whole set of production, commercial, organizational and economic indicators. It is determined by the aggregate of consumer properties of the given product by the degree of compliance with social needs, taking into account the costs of their satisfaction, prices, conditions of supply and operation in the process of production or personal consumption.

The conditional formula for the competitiveness of a particular product type can be represented as a set of qualitative and cost characteristics of products that contribute to the creation of the benefits of the parameters of this product to the competitors' products in meeting the specific needs of the consumer (1):

$$C = \frac{\text{quality}}{\text{price}} \rightarrow \max \quad (1)$$

In this interpretation, the competitiveness indicator ( $C$ ) reflects the proportion of product quality per unit of its price. However, the researched indicator is determined by the ratio of the beneficial effect (only a certain part of quality) to the total costs associated with the acquisition and exploitation of products. Consequentially, in the consumer's understanding, such a correlation should go to its maximum value.

The buyer substantiates the choice of products, assessing the beneficial effect of its use and the costs associated with its purchase and use (2):

$$C = \frac{Ee_i}{Pc_i} \rightarrow \max \quad (2)$$

where  $Ee_i$  — an economic (beneficial) effect of consumption of the  $i$ -th product;  $Pc_i$  — total expenses of the consumer on purchase and consumption of the  $i$ -th product in the conditions of a specific market.

The filling of the modern Ukrainian market with high-quality, competitive fruit and berry production of domestic production is possible due to the introduction in Ukrainian gardens of domestic and foreign breeding varieties, which are characterized by high commodity and taste qualities of fruits, as well as high adaptability to the conditions of a particular zone. The long-term studies of breeders and pomologists determined that for the Forest-steppe Ukraine (the forest-steppe stretches from the Southwest from the border with Moldova to the Northeast to the border with Russia through the central part of the country, 33% of the territory of Ukraine), such are Askolda, Amulet, Gala Mast, Johnogold de Costa, Delicia, Katerina, Karazinskaya, Mavka, Melrose, Radogost, Teremok, Edera. The yield of these varieties in 4-8-year-old plantations of intensive type reaches 22-60 t/ha. Tasting appraisal of the taste and quality of the fruits is 4.4-4.9 points.

Exploring the characteristics of a particular variety of fruits and berries, we came to the conclusion that some varieties fully meet the needs of both producers and consumers. The results of an expert evaluation of apple varieties indicate the biological importance of a single variety that affects the level of expenditure (for example, disease resistance, transportability, early entry into commodity fruiting), the level of sales price (for example, taste, appearance, size of the fruit), and respectively, on the quality of the fruits (reducing the amount of chemical spraying, the content of vitamin C, pectin, etc.) (Table 3).

This assertion gives grounds to conclude that the initial qualitative and cost indicators of production are laid at the stage of creating a separate variety — geneticists, breeders. The seeded cultivar, the cultivated plant that has improved disease and pest resistance rates, better quality characteristics, will have advantages over other, less competitive varieties. The issues of product adaptation capabilities in an emerging market context were studied by Rejie George et al. (2018).

Experts in the industry prove that the use of high-immunity fruit crops is: saving up to 70-75% of the costs required for plant protection; high commodity quality of the obtained fruits; a simplified scheme for protecting the garden from pests and diseases (spraying up to 6 times a year); 30% more healthy fruits; high productivity, stable harvests; unpretentiousness of plants to climatic conditions, which allows to grow products throughout the territory of Ukraine; frost resistance; products that meet international standards; reduction of anthropogenic impact on the environment.

**Table 3.** Biological and ecological indicators of competitiveness of some apple varieties that are common in Ukraine

Apple tree variety		Biological and ecological indicators of competitiveness of the variety, score											
		Resilience to diseases			Frost resistance	Introduction to fruiting	Potential yield	Chemical composition	Weight of the fruit	Transportability	Taste	Possibility of storage without loss of taste	Average score
		Scars	Fluffy dew	Bacterial burns									
Summer	Melba	0	2	-	3	4	2	4	2	1	5	2	2,5
	Papirovka	2	2	-	3	4	2	5	2	2	4	2	2,8
Autumn	Slava Peremozhcjam	1	3	-	3	5	1	5	3	3	5	2	3,1
	Champion	4	2	1	1	3	3	4	3	1	5	4	3,0
	Delicia	3	3	3	3	2	1	4	3	2	5	1	2,7
	Liberty	4	1	-	2	3	3	4	2	3	4	3	2,9
	Novomac	4	4	-	3	3	2	4	3	3	5	2	3,3
Winter	Jonagold de Coster	1	2	1	1	3	3	4	4	3	5	3	2,9
	Golden Delicious	2	2	2	1	3	1	4	3	3	5	3	2,7
	Renet Semerenko	0	0	-	1	3	3	5	3	3	5	4	2,7
	Florina	4	3	-	1	3	1	4	2	3	4	4	2,9
	Gloster	2	4	-	4	2	2	4	3	3	5	4	3,3
	Gala Mast	2	4	2	1	2	2	4	2	1	5	3	2,8
	Eliza	3	3	-	1	2	3	4	3	3	4	4	3,0

*Source:* The authors' own calculations based on evaluation of industry experts, characteristic of a separate variety

**Biological and ecological indicators of competitiveness of some apple varieties that are common in Ukraine, were culculated by the following methods:**

Resilience to diseases on the scale 0-4: 0- very affected, 1- affected, 2 - moderately affected, 3 - weakly affected, 4 - resistant, and «-» is absent.

Frost resistance and winter stability on a scale of 0-3: 0 - unstable, 1 - medium resistance, 2 - stability above average, 3 - high stability.

Introduction to fruiting on a scale of 0-4, depending on the year: on 6 - 0, on 5 -1, on 4 - 2, on 3 - 3, on 2 - 4.

Potential yields on a scale of 0-4: up to 40 kg per tree- 0, 40-60 kg per tree - 1, 60-80 kg per tree - 2, 80-100 kg per tree - 3, over 100 kg per tree - 4.

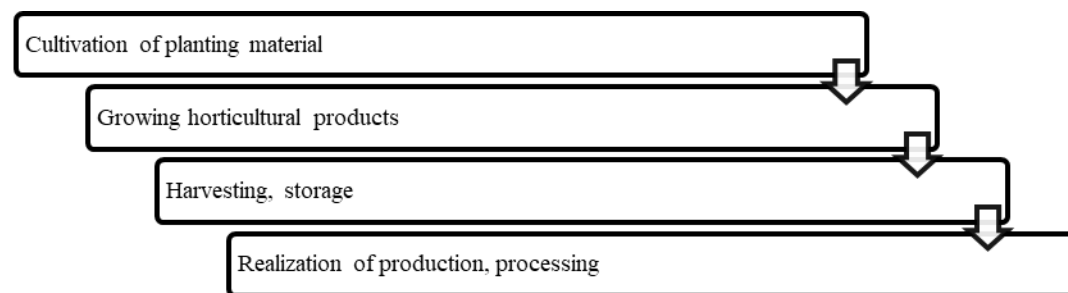
The chemical composition is estimated by the author depending on the content of pectin and vitamin C in 100 g of raw mass on a scale of 0-4, depending on the weight of the fruit: small (16-70 g) - 0, smaller than average (71-110 g) -1, average size (111-150 g) -2, larger than average size (151- 200g) - 3, large (201-350g) - 4.

Transportability on a scale 0-3: 0- not transportable, 1 - average transportability, 2 - transportability higher than average, 3 - high transportability.

An expert assessment of the taste of fruits is approximated by the authors to an integer.

The duration of storage is estimated on a scale of 0-4, depending on the number of storage date for three groups (summer, autumn, winter).

In the process of growing, harvesting, storing and transporting, only compliance with and improvement of the qualitative indicators of the competitiveness of fruit and berry products takes place. The process of forming and improving the competitiveness of fruit and berry products can be reflected in stages (Figure 1).



**Figure 1.** Technological stage-by-stage process of formation, observance and improvement of indicators of competitiveness of horticultural products. *Source:* Development by authors

According to the existing classical technique of product competitiveness it is not fully reflect all the parameters of the competitiveness of horticultural products, and therefore should be revised and improved. We consider it necessary to specify quantitative and qualitative parameters that are included in the formula for calculating the level of competitiveness of horticultural products.

The general indicator of competitiveness of horticultural products is an integrated indicator of competitiveness (3):

$$I_{c(j)} = \frac{I_{bl(i)} \cdot I_{eg(i)} \cdot I_{pr(i)}}{I_{ec(i)}}, \quad (3)$$

where  $I_{c(j)}$  — the integrated index of competitiveness of the analyzed pomological variety of horticultural product ( $i$ ) in relation to the sample variety;  $I_{bl(i)}$  — group indicator for biological parameters;  $I_{eg(i)}$  — group indicator for ecological parameters;  $I_{pr(i)}$  — group indicator for production parameters;  $I_{ec(i)}$  — a group indicator for economic parameters (cost of consumption).

The biological characteristics should include indicators that depend on a set of actions of cultivation and growing of fruit-bearing plantations, for example: resistance to diseases, frost resistance, the period of introduction into fruiting, yields, etc. The ecological characteristics should include the parameters contained in the normative documents, standards and reflect the requirements of technical, environmental, moral and ethical safety of products: color, taste, chemical composition. Production and economic parameters of production form its production cost at the enterprise.

Group indices are single, and their value is calculated as an additive form of a complex indicator with weight coefficients. The formula for horticultural products will look like (4):

$$I_{gr(j)} = \sum_{i=1}^n q_{i(j)} \times a_i, \quad (4)$$

where:  $I_{gr(j)}$  is a group index of a separate pomological variety;  $q_{i(j)}$  is a unit parametric index for the  $i$  parameter of the  $j$  pomological variety;  $a$  — the weight of the  $i$  parameter;  $n$  — number of parameters being analyzed.

After conducting surveys of specialists of the industry, and consumers of products that evaluated the qualitative characteristics of a particular variety on a five-point scale, we determined the ranking of competitiveness indicators for the producer and consumer. Taking as a basis the methodology for calculating the competitiveness used during the compilation of the Global Competitiveness Report, we calculated the points. Estimated values are rounded by the authors to an integer.

#### Calculated average quality

indicators of a separate variety of apples are converted to the corresponding weighting factor according to the following method: the average score "0" is the weight coefficient — 0.25; average score "1" — weighted coefficient — 0.5; average score "2" — weight factor — 0.75; average score "3" — weighted coefficient — 1; the average score is "4" — the weight factor is 1.25; the average score is "5" — the weight factor is 1.50.

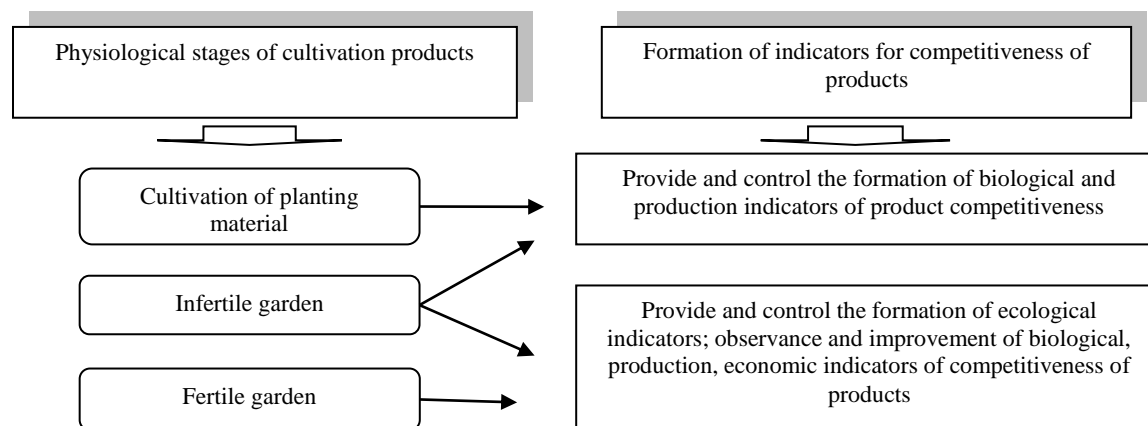
In accordance with this method it is possible to calculate the competitiveness of a separate apple variety for producer and consumer (Table 4).

**Table 4.** Method of determining weight coefficients of quality indicators of a separate variety for producer and consumer, scale of assessment from 0 to 5 points

Qualitative indicators of competitiveness	Producer		Consumer	
	average score on the results of the survey	weight factor	average score on the results of the survey	weight factor
Yield	5	1.50	0	0.25
Introduction to fruiting	5	1.50	0	0.25
Expiration date	5	1.50	3	1.00
Taste, color	4	1.25	5	1.50
Resistance to scab	5	1.50	0	0.25
Weight of the fruit	4	1.25	4	1.25
Transportation ability	3	1.25	3	1.00
Resistance to powdery mildew	4	1.25	0	0.25
Resistant to bacterial burns	3	1.00	0	0.25
Chemical composition	3	1.00	5	1.50
Frost resistance	4	1.25	0	0.25

*Source:* Own calculations based on the survey of specialists of the industry, consumers of products

The system of phased evaluation of horticultural production, which makes it possible to assess the impact of basic biological, ecological, production and economical parameters of horticultural products on the level of its competitiveness, includes: the basic physiological stages of production and the maintenance and control of the formation and improvement of its indicators (Figure 2).



**Figure 2.** Formation of competitiveness of horticultural products

*Source:* Development by authors

The proposed method for evaluating the competitiveness of fruit and berry products will increase its competitiveness, quality and biological value, as it takes into account the output of biological, ecological and production value per unit of spent resource.

Kondratenko (2000) concluded that the fruits of varieties of summer and autumn ripening, grown mainly in Polissya and Forest-steppe of Ukraine, have a stable and equivalent taste due to the content of almost equal number of basic organic substances and the same ratio of sugars and acids. However, we cannot say the same about the apples of Golden Delicious and Renet Semerenko, their biochemical composition and taste varies



according to the region of cultivation. Therefore, in order to ensure the competitive production of horticultural products, the genetic potential of each individual variety and the compliance with its soil and climatic conditions in the region must be fully taken into account. This approach will allow producers to some extent control the costs and prices of horticultural products.

## Conclusions

The current study analyzes the competitiveness of horticultural products in Ukraine. The assessment of the industry indicates unsatisfactory trends in the development of domestic horticulture, which does not contribute to its competitiveness. In order to enter the foreign markets, horticultural products must meet certain quality standards, be safety and biologically valuable — only such products can take their place among competitors.

It was investigated that the importance in the process of forming the competitiveness of horticultural products is given to a separate variety. The evaluation of the biological and ecological indicators of competitiveness points to the advantages and disadvantages of a separate apple variety. Taking into account the importance of qualitative indices of a particular variety for the formation of the general competitiveness of horticultural products, we suggested an improved methodology for evaluating the competitiveness. We suggested calculating indices of competitiveness of horticultural products to include ecological, biological, production and economic parameters of competitiveness. The research also highlighted the industry stages of the formation, observance and improvement of the competitiveness parameters of horticultural products. Taking into account the weight factor of a separate index of competitiveness of horticultural products, on the basis of the suggested methodology, it is possible to calculate the competitiveness of both the producer and the consumer of products.

In addition to the factors taken into consideration in the investigated parameters, the general competitiveness of horticultural products is influenced by others, both external and internal factors. In our opinion, among the main factors hindering the competitiveness of domestic products are:

- a low selling price for horticultural products, which does not depend on the quality level;
- insufficient industry support from the state, science;
- lack of cooperation in horticulture;
- lack of funds, equipment, special equipment from manufacturers of products;
- imperfection of the certification process, product testing. Incompatibility of domestic quality standards to European ones;
- unstable economic and political situation in the country.

## References

- Shestopalj, O., & Jermakov, O. 1998. Organizational and economic factors of adaptation of gardening to the market (Orghanizacijno-ekonomichni chynnyky adaptaciji sadivnytva do rynku), *Gardening*, 47: 257-260 (in Ukrainian).
- Statistic Service of Ukraine (2017) *Ploshchi, valovi zbory ta urozhainist kultur, plodiv, yahid ta vynohradu u 2016 rotsi* (Squares, gross production and yields of crops, fruits, berries and grapes in 2016 year), Kyiv: Derzhavna sluzhba statystyky Ukrainy (in Ukrainian).
- Kondratenko, T., & Ghoncharuk, U. 2017. Peculiarities of fruiting and taste quality of fruit of the new generation of apple varieties immunized to the scallop in the conditions of the forest-steppe of Ukraine (Osoblyvosti plodonoshennja ta smakovi jakosti plodiv imunnykh do parshi sortiv jabluni novogho pokolinnja v umovakh Lisostepu Ukrajiny). In *Selection-genetic science and education* (p. 145 - 146). Uman: Uman National University of Horticulture (in Ukrainian).
- Ruliev, V. 2007. *The Competitiveness of Fruits and Berries: Monograph* (Konkurentospromozhnistj plodiv i jaghid: monohrafija). Melitopol: MMD (in Ukrainian).



Kushniruk, V., Ermakov, O. & Shebanina, O. 2009. *Organizational and economic mechanism of effective gardening in agrarian enterprises of the region: Monograph* (Orghanizacijno-ekonomichnyj mekhanizm efektyvnogho vedennja sadivnyctva v aghrarnykh pidpryjemstvakh rehghionu: Monoghrafija). Mykolajiv: MDAU (in Ukrainian).

Shestopalj, O., Kondratenko, P & Barabash, L. 2008. *Theoretical and methodological foundations (the new paradigm) and components of the National Program for the Advancement of Industrial Horticulture in Ukraine: Macroeconomic Aspect: Monograph* (Teoretyko-metodologichni osnovy (nova paradyghma) ta skladovi Nacjonaljnoji prohramy postupu promyslovogho sadivnyctva Ukrajinjy: makrohgaluzevyj aspekt: monoghr.). Kyiv: NNC IAE (in Ukrainian).

Gutorova, O. & Sherstyuk, S. 2013. *Marketing strategy of gardening development: theoretical and applied aspect: Monograph* (Marketynghova strateghija rozvytku sadivnyctva: teoretyko-prykladnyj aspekt: monoghrafija). Kharkiv: KhNAU (in Ukrainian).

Karpenko, V., Burliai, A., Burliai, O. & Mostovyak, M. 2016. Ukrainian garden trends under globalization, *Economic Annals – XXI*, 161 (9-10): 51-55. <http://dx.doi.org/10.21003/ea.V161-12>

Ruliev, V. 2004. *Economic problems of Ukrainian horticulture development: Monograph* (Ekonomichni problemy rozvytku sadivnyctva Ukrajinjy). Kyiv: NNC IAE (in Ukrainian).

Kondratenko, T, Kondratenko, P. & Chyzh, O. 1999. Stability of young trees of perspective apple varieties to low temperatures in the autumn-winter period (Stijkistj molodykh derev perspektyvnykh sortiv jabluni do nyzjkykh temperatur v osinnjo-zymovyj period), *Gardening*, 48: 184-189 (in Ukrainian).

Puškarić, A., Jeločnik, M. & Ivanović, L. 2009. Analysis of Vegetable Production in the European Union with Retrospection on the Conditions in Republic of Serbia, *BULETINUL Universităţii Petrol – Gaze din Ploieşti*, 3, 36-43. Retrieved from <http://bulletin.upg-ploiesti.ro/toc.jsp?page=1287&pageType=SEc&language=2>.

Broeck, G. & Maertens, M. 2016. Horticultural exports and food security in developing countries, *Global Food Security*, 10, 11-20. <https://doi.org/10.1016/j.gfs.2016.07.007>

Godoy-Durán A., Galdeano- Gómez E., Pérez-Mesa J. & Piedra-Muñoz L. 2017. Assessing eco-efficiency and the determinants of horticultural family-farming in Southeast Spain, *Journal of Environmental Management*, 204 (1), 594-604. <http://dx.doi.org/10.1016/j.jenvman.2017.09.037>

Jablonska, J., Filipiak, T. & Gunerka, L. 2017. Cost competitiveness of horticultural farms in Poland and selected EU countries. (Konkurencyjność kosztowa gospodarstw ogrodniczych w Polsce i wybranych krajach UE). <https://doi.org/10.22630/PRS.2017.17.1.6>.

Pearcea, D., Dorab, M., Wesanaac, J., & Gellyncka X. 2018. Determining factors driving sustainable performance through the application of lean management practices in horticultural primary production, *Journal of Cleaner Production* 203: 400-417. <https://doi.org/10.1016/j.jclepro.2018.08.170>

Shumpeter, J.A. 1983. *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. New Brunswick and London: Fransaction Publishers.

Porter M. 1987. *From Competitive Advantage to Corporate Strategy*, HBR.

The Global Competitiveness Report 2018. Retrieved from <http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf>

Statistical bulletins: *Harvest of crops, fruits, berries and grapes in the regions of Ukraine, 2011-2017*. State Statistics Service of Ukraine. Retrieved from <http://www.ukrstat.gov.ua>

Statistical bulletin 2017: *Costs for the production of agricultural products in agricultural enterprises for 2016*. State Statistics Service of Ukraine. Retrieved from <http://www.ukrstat.gov.ua>.

Cicco, A. 2016. *The fruit and vegetable sector in the EU - a statistical overview*. Retrieved from [http://ec.europa.eu/eurostat/statistics-explained/index.php/The\\_fruit\\_and\\_vegetable\\_sector\\_in\\_the\\_EU\\_-\\_a\\_statistical\\_overview](http://ec.europa.eu/eurostat/statistics-explained/index.php/The_fruit_and_vegetable_sector_in_the_EU_-_a_statistical_overview).

Apple season-2017/18 in Ukraine: a test of bad weather and new realities. Results of the seventh international conference "Apple Business of Ukraine-2017". Retrieved from <https://www.fruit-inform.com/ru/Summary/174889#.WwJ1Jx9oPDc>

YAO Yuchen, Jiang Fangtao, Zhang Li. 2013. Study on quality control of modern agricultural supply chain based on food safety. Retrieved from

[https://scholar.google.com.au/scholar?hl=en&as\\_sdt=0%2C5&q=.+YAO+Yuchen%2C+Jiang+Fangtao%2C+Zhang+Li.+Study+on+quality+control+of+modern+agricultural+supply+chain+based+on+food+safety&btnG](https://scholar.google.com.au/scholar?hl=en&as_sdt=0%2C5&q=.+YAO+Yuchen%2C+Jiang+Fangtao%2C+Zhang+Li.+Study+on+quality+control+of+modern+agricultural+supply+chain+based+on+food+safety&btnG)

Shpichak, O. M. 2010. Quality and price of agricultural products. (Jakistj i cina siljsjkoghospodarsjkoji produkciji). *Scientific Bulletin of NUBiP of Ukraine*, 154 (1), 11-19 (in Ukrainian).

CAC 2005: *Understanding the Codex Alimentarius*. World Health Organisation (WHO) and Food and Agriculture Organization of the United Nations (FAO) Rome. Revised and updated 2005. Retrieved 2005, from <http://www.fao.org/docrep/008/y7867e/y7867e00.htm>

ISO 22000:2018. Food safety management systems — Requirements for any organization in the food chain.

Verkhovna Rada of Ukraine. 1998. *Basic Principles and Requirements for the Safety and Quality of Food Products: Law of Ukraine*. Retrieved from <http://zakon.rada.gov.ua/laws/show/771/97-bp> (in Ukrainian).

George, R., Beine J., Arnold U. Resource configurations, product development capability, and competitive advantage: An empirical analysis of their evolution, *Journal of Business Research*, 85, 32-50. <https://doi.org/10.1016/j.jbusres.2017.11.045>

Kondratenko, T.E. 2000. Immune varieties and their role in improving the assortment of apple in Ukraine (Imunni sorty ta jikh rolj v udoskonalenni sortymentu jabluni v Ukrajinu). *Gardening*, 51: 28 - 34 (in Ukrainian).

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## PROJECTION OF ENTERPRISE SURVIVAL RATE IN DYNAMICS OF REGIONAL ECONOMIC SUSTAINABILITY: CASE STUDY OF RUSSIA AND THE EU

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**Abstract.** Discussing the problem of economic sustainability, we are in general deal with life cycles and economic activity. Factors causing dynamics in entrepreneurial ventures, their duration and process rate depend on environmental conditions, including institutional, market, infrastructure, and resource aspects. A cumulative impact of all of these factors appears at a specific level of enterprise survival, which becomes a universal characteristic of sustainable economy. Going from official statistics on business demography and complementary empirical data, in this research, we focus on enterprise survival trends in Russia and the EU. The results obtained for Russia assume that in a number of industries, there is an intensive turnover of companies. Over the past two years, a medium-term trend towards a reducing number of enterprise births and increasing number of enterprise deaths in Russia has had a negative ratio. The average enterprise survival rate within a horizon of one year (2013/2014) was 74% in Russia and 77% in the EU. For a five-year period of 2009/2014, the average enterprise survival rate was less than 55% and 45% respectively. In general, in countries with a low average enterprise survival rate, in the first year, there is a persisting low rating in almost all of the industries, assuming that trends in enterprise sustainability dynamics depend on an overall economic situation instead of specifics in a particular sector. An important conclusion from the research is that the long-term survival rate of Russian companies is clearly higher, while the short-term one is lower than that of companies in the EU.

**Keywords:** economic sustainability; economic activity; entrepreneurship; enterprise survival; business demography; adaptation strategies

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**JEL Classifications:** D81, E30, L26

## 1. Introduction

Regions are distinct in their economic structure, resource availability, production factors, infrastructure availability, specifics of customer behaviour and other aspects (Armington & Acs, 2002; Beugelsdijk, Klasing & Milionis, 2018; Capello, 2010; Capello, 2011; Crescenzi, Luca & Milio, 2016; Gerlach & Wagner, 1994; Wennekers & Thurik, 1999; Tvaronavičienė & Gatautis, 2017; Schouten, 2019; Sasongko, Huruta & Wardani, 2019; Zeibote, Volkova & Todorov, 2019; Prakash, & Garg, 2019).

These differences affect a ratio of competitive power, making long-term trends in a movement of resources. At a level of economic agents, interregional differences manifest themselves in a number of measurable that are indicators of their sustainability (Fertala, 2008; Mata & Portugal; Tödtling & Wanzenböck, 2003). The enterprise survival rate is one of these indicators. Obviously, underlying determinants of survival dynamics are highly diverse, have various powers and an action direction. However, as we see it, it is the survival rate that does not only cumulatively mirror a quality of an institutional environment (whether it provides favourable conditions), but also self-organizing capabilities of companies facing a risk of market uncertainty. Therefore, the problem of ways to improve an institutional support to entrepreneurs for sustainable running of economy has recently become of particular relevance (Harris & Robertson, 2001).

The dynamics of agents' numbers is a kind of an indicator for an *economic health*. At the same time, it is necessary to understand that entrepreneurship is not just a profit-making activity, but also an activity performed at one's own risk (Knight, 1965). This means that companies will inevitably face challenges, which in the end might lead them to their closedown. A totality of the data, such as a number of dissolved, recently incorporated and active companies is the first definable value in statistics on business demography. A subsequent data analysis makes it possible to estimate the survival rate of economic agents.

To make strategic managerial decisions, one should consider a demographic situation in a sector/region combined with internal factors of an enterprise competitive power and conditions of an external environment. Techniques for a study of the competitive power applied to business demography data (as viewed chronologically) make it possible to judge importance of certain comparative indicators for a enterprise life cycle. This is important for strategy design and implementation of internal transformations (Müller & Pfleger, 2014; Tobias & Scheermesser, 2006). A circular reference between development rates of entrepreneurship and changes of an *entrepreneurial climate* depends on bi-directional trends. An increased concentration of enterprises might lead to both a creative destruction (following Sombart (1913) and Schumpeter (1961)), and positive spill-over effects, accumulation of entrepreneurial experience, as well as long-term multiplier effects through loops of a positive feedback against the background of business cycles in economy. Krugman (1991), Porter (2000), etc. have reviewed in detail cyclical effects of area development and an influence of regional differences. Representatives of many schools of economy, from neo-classicists (Solow, 1956; Swan, 1956) and supporters to the theory of regional development (Myrdal, 1957), to more recent concepts, such as the agglomeration theory (Romer, 1992; Krugman, 1991; Richardson, 1973) and many others, were pursuing to explain regularities of regional competition.

The issues, such as an achievement of a sustainable enterprise life cycle and economy development in general, had caused a need in a systematic study of enterprise survival. Going from cases of large regional economic structures, Russia and the EU, in this research, we aim at identification of factors in demography dynamics and a comparison between states of business demography.

The identified research issue largely relates to an understudied practice-oriented analysis of enterprise life cycles. A reason for this is both limited statistical data, and a lack of shared methodological approaches. Related research objectives are to define cause-and-effect regularities and anomalies in dynamics of the enterprise survival rate that

might manifest themselves during overall recessions and have time-delayed consequences (*time lag effect* and *memory effect*). This disposition of invert correlations is our basic hypothesis, which we hope to validate next.

## 2. Literature review

A sustainable development of an enterprise largely depends on an extent, to which it has overcome systemic and non-systemic risks. It seems that it is possible to associate the first field-specific studies of survival risks to new enterprises with Stinchcombe (1965), who introduced the concept of *novelty vulnerability effect*. Stinchcombe believes that this effect explains a phenomenon of ceased activities of innovative enterprises. A new enterprise in its life cycle might quickly change its state (Garnsey, Stam & Heffernan, 2006; Adizes, 1979). In this process, agents definitively decide whether they will be workers or innovators in an economic system (Lucas, 1978). An unstable demographic status of new enterprises Stinchcombe associates with at least three factors. First, there is a factor of increased costs in incorporation time as a market niche its operations has not been clear yet. There is a process, in which an enterprise develops a dynamic strategy being in a search for tools to implement the strategy. Secondly, available resources are limited. Third, there are problems in an in-house environment of the enterprise. We mean a system of management and relations, decision-making errors, related among other things to individual determinants of organizational death rate (Preisendörfer & Voss, 1990), consequences of these decisions or a risk of a change in *rules of the game* as the enterprise relies on new values in operations and they might be contrary to norms of an existing social paradigm.

In the empirical study, Ernst & Young together with the Russian Venture Company (RVC) have highlighted amazing survival trends among new advanced enterprises established in business incubators (Ernst & Young, Russian Venture Company, 2014). According to data for 2014, upon an end of the Russian business incubator program, only 27% of enterprises were in the market in a year upon incorporation, while in the USA and Europe, the corresponding indicator was 87 and 88%, respectively. Arshakuni, Kuzminov and Shirokov (2016) studied essential determinants of survival and sustainability rates of small Russian enterprises. Kuzmin (2018) enlarges empirical data on Russian business demography assuming that the organizational immunity as a response to specifics of a business environment is crucial for duration of an enterprise life cycle, while the enterprise survival rate points out to a development quality of markets and an institutional infrastructure.

The survival rate of enterprises focused on exported goods or services as a problem seems urgent. As Kuznetsov (2017) mentions in the practice-oriented research, some Russian enterprises have had international operations for a long time, but most enterprises usually leave overseas markets earlier than 2 years after incorporation. There had been annual updates (by about one third) to a composition of Russian exporting enterprises, while their total number remained without significant changes in 2004-2015. At the same time, indicators of export merchants' sustainability were up to 10% higher among manufacturing companies than among mining and trading businesses. Along with enterprise heterogeneity, researchers often regard fixed export costs as decisive factors of high dynamics in business demography of exporting enterprises (Melitz, 2003). The previously described concept of novelty vulnerability had its development in Hannan and Freeman (1984) with their conclusion that one should search for the lowest death rate among enterprises with the highest rate of in-house inertia instead of among the most efficient enterprises. In an enterprise development, in-house inertia becomes higher, which makes higher an ability of an enterprise to self-organization and as a result, its ability to survive. Business demography data also point out to specifics of economic activity (Plummer & Pe'er, 2010) and resistance to external and internal risks. Later, researchers provided reasons for the approach, according to which a threat does not only include a factor of novelty, but also the so-called small-size factor (Aldrich & Auster, 1986). A relatively small capital of small enterprises narrows a production framework and sets limits to possible attracting of additional resources. At the same time, they are distinct in their high levels of investment efficiency (International Fund of Support to Economic Reforms in Russia, 1994). Federico and Capelleras (2015) conclude that a growth of *young* enterprises has a positive effect on profits, while, on the contrary, the effect of profits on the growth is insignificant. Limited



resources of small and medium-sized enterprises are largely responsible for a relatively short life cycle that might be longer (2003). The concept of youth vulnerability (Bruderl & Schussler, 1990) matches these ideas: enterprise survival and death rates are nonlinear. As long as a company turns into a market player, a death risk gets lower.

It is obvious that data of empirical statistics make it possible to predict future trends better. Regional data on business demography play an important role solving of problems (employment, economic activity, and economic growth). A multivariate analysis of enterprise life cycles in various industries makes it possible to develop strategies to achieve higher concentrations of entrepreneurial activities in socially disadvantaged regions (Reiner & Gassler, 2017). Statistical offices (Eurostat), special-purpose research projects, such as PREDICT (Rossetti, 2017) in IT and telecommunications in Europe, to a large extent contribute in studies of business demography, forecasting and making recommendations on the entrepreneurship development by sector. Based on accumulated data, let us compare the survival rate of enterprises in Russian and EU as important actors in economy. To do this, it is necessary to clarify the techniques that are in use for an estimation of the survival rate based on various data sets and bring them to a common format to ensure representativeness of an analysis.

### **3. Materials and Methods**

Basic statistics on business demography includes information of manifested enterprises' activities. However, in business registers, such activities are not a subject of monitoring to the proper extent. Only some countries possess reporting data that might be a basis for further estimations of enterprise survival rates using comparable values. The Organization for European Economic Cooperation (OECE) and Eurostat have jointly developed the "Program of Indicators of Entrepreneurial Activity" based on business demography data (OECD). Dynamics of enterprise births and deaths, as well as a survival percentage for two years are an important part of structure coefficients in progress monitoring under the updated Lisbon Strategy (The Community Lisbon Program, 2005). The European Parliament Regulation on structural business statistics also requires collecting of data on business demography and their annual submission (Concerning structural business statistics, 2008).

In accordance with the classifier of economic activities, NACE Rev. 2 (Eurostat), business demography indicators are collected by enterprises that belong to sections B-N, except for group 64.2 (management activities of parent companies), as well as voluntarily by sections P-S. Thus, statistical data cover activities of industrial, construction, trade enterprises, and service companies, but exclude agricultural and public sectors, as well as extraterritorial offices and non-market economic activities of households.

The reason is specific information coverage that business statistics registers provide. Note that in some countries, it is usual to account for enterprises that have achieved a certain threshold of financial and economic performance indicators (Simonova & Ovsyankina, 2016). So far, business statistics cover those actors who have market-oriented forms of ownership. They also do not take into account (in calculation) new enterprises that appear in the EU, those enterprises that re-start operations within two years upon termination of activities, registration of new enterprises as a result of mergers, spin-off/restructuring and a changed type of activity of an enterprise.

The enterprise survival depends on the fact that a company remains active before and after a particular demographic event. Therefore, a birth of new enterprise is often one of the key factors that cause provision of new jobs influencing the economic growth. New enterprises promote innovations and facilitate an introduction of new technologies, as well as an increase in overall performance in economy (Braunerhjelm 2010; Gerguri & Ramadani, 2010).

The Rosstat (2014) methodology assumes that an enterprise birth is a combination of production factors, taking into account that no other enterprise is involved in this event. Objects of observation were commercial organizations on the Unified State Register of Legal Entities in Russia, operating in all sectors of economy except

for public administration, housekeeping services and activities of extraterritorial organizations. We calculate the enterprise birth rate as a ratio between a number of registered enterprises for a reporting period and an average number of enterprises as calculated per 1,000 enterprises. There is a similar approach to the enterprise death ratio. Both in Russia, and the EU, the enterprise death rate does not cover data on retirement of existing enterprises as a result of a merger, spin-off/division or restructuring and changed operations. At the same time, the survival refers to maintenance of economic activity by an enterprise for a certain number of years. We consider an enterprise a survivor (that has been continuing operations) if, incorporated in year of  $T(t)-n$ , it is economically active in year of  $T(t)$ . According to methodological guidelines by Rosstat, the enterprise survival rate is always a comparison between two consecutive years or continuously throughout a period in question. Official statistics limits itself to calculating the survival rate for a period up to  $T(t)-5$ .

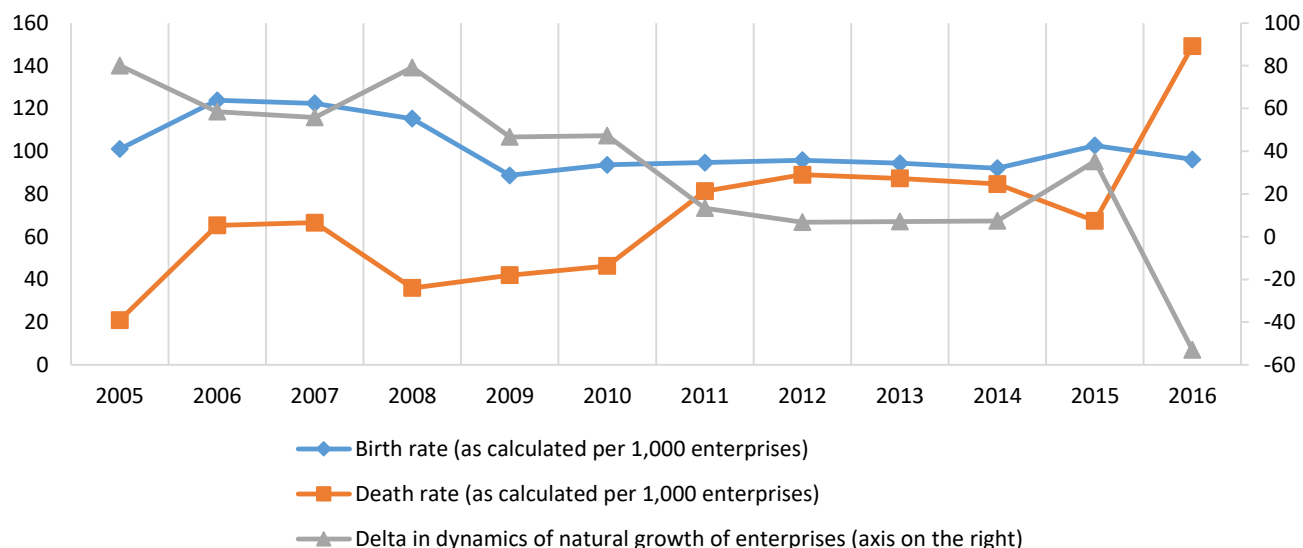
The Rosstat data panel (regarding the enterprise survival rate) comes down to recent statistics starting from 2017. Before that time, there had been no official observations of the enterprise survival rate in Russia. Empirical works by various researchers fill a gap in data of government monitoring. At the same time, such studies do not always have a coordinated result that they present or are not representative by size of a sample of actors. For example, an average age of Russian enterprises across the sample by Shirokova *et al.* (2006) was 19.2 years in 2006. In 10 years, in 2016, it was 7.8 years (Ivonen & Shirokova, 2016). According to Shamray (2010), in 2010, the average age of enterprises was 7.1 years. At the same time, there were no evaluations of the relative survival rate for various time intervals.

The first large-scale study with a solution to this problem dates back to 2016 held by a group of researchers led by Kuzmin at the Institute of Economics of the Ural Branch of the Russian Academy of Sciences and the Ural State University of Economics (Kuzmin, 2017; Kuzmin, 2018; Kuzmin & Guseva, 2016). The empirical research is distinctive in its original approach. It makes it possible to adjust an enterprise lifetime to a framework of a conditionally active period, during which enterprises show signs of involvement in financial and operational activities. The edition of collected works presents data on the enterprise survival in Russia in 1991–2014 (2015 was final for the comparison).

Due to a wide coverage, estimated values of the enterprise survival rate are given up to  $T(t)+23$ . A distinctive feature of the approach is a modified calculation base, where  $T$  is a year of an enterprise birth. This circumstance leads to a need in a conversion tool for data formats for a comparative analysis. Further, it is necessary to study empirical data by enterprise survival rate in Russia and Europe. This will make it possible to identify key differences and identify factors that influence values.

#### 4. Results

It is not only possible to describe spatial distribution of entrepreneurial activity as significantly differentiated by region, but also it is possible to say that localization of high and low business concentration was biased (Plummer & Pe'er, 2010). At the same time, of course, one should keep in mind that a situation with demography dynamics is not the same. Consider first dynamics in enterprise demography indicators in Russia (Figure 1).



**Fig. 1.** Enterprise birth and death rates in Russia in 2005-2016

Source: (Rosstat).

The retrospective review of 2005/2016 shows that the enterprise birth rate was from 88.7 (the least value in 2009) to 123.8 (the highest in 2006). The average value of the enterprise birth rate is 101.7. There was relatively high enterprise birth rate in three consecutive years in the first half of the period in question: in 2006–2008, there was a peak of values, and immediately after - the least value in 2009. From 2009 and almost until an end of the period, the coefficient was in a *red zone* (values below the average). Dynamics was stable and, as late as in 2015, there was a local growth to 102.7.

The retrospective review of 2005/2016 on the enterprise death rate says that values were clearly less smooth. In general, dynamics is positive, values increased from 20.9 (the least value corresponding to the beginning of the period of 2006) to 149.2 (the highest value in 2016). The average value was 69.7. Dynamics of enterprise death rate was getting much more intensive almost throughout the whole period in question except for a local decline in 2008–2010. Also, note a sharp peak of the enterprise death rate in 2016, when the ratio increased 2.5 times to the record level, from 67.4 to 149.2.

In general, in the mentioned period, enterprise birth and death rates had multidirectional dynamics, however, local retrospective sections have coincidences, as well as discrepancies (up to an inversion) and it is possible to explain this with a multifactorial influence on the development of enterprise demography in Russia.

We believe that, to a certain extent, a simple incorporation procedure and liberal requirements are reason for high enterprise birth and death rates in Russia, for example, requirements to the authorized capital (Volkonitskaya, 2006). We attribute a certain contribution to higher numbers in some Russian regions to changes in local legislation (in terms of tax regulation and working conditions for certain activities), which in some cases might lead to deaths of some enterprises and formation of new structures in another region, kind of enterprise migration. An important reason for higher enterprise death rates is also recession in the Russian consumer market.

Thus, there is a clear trend towards a decline in a number of enterprise births and deaths. At the same time, a ratio between born and dead Russian enterprises has recently become negative.



**Table 1.** Distribution of active enterprises in Russia in 2017 by age

Economic activity / Indicator	Number of active enterprises	including					
		born	one-year	two-year	three-year	four-year	five-year
Total	100.0% 3802007	9.5%	11.1%	10.4%	8.8%	7.3%	6.3%
Extraction of mineral resources	0.4%	9.0%	11.0%	9.2%	8.4%	6.3%	6.1%
Manufacturing industries	8.2%	8.0%	9.4%	9.0%	8.2%	7.2%	6.4%
Supplies of electricity, gas and steam, air conditioning	0.5%	5.7%	7.7%	8.1%	8.0%	7.3%	7.3%
Construction	12.5%	12.2%	12.7%	10.7%	9.3%	7.8%	6.4%
Wholesale and retail trade, repair of motor vehicles and motorcycles	38.4%	10.1%	12.5%	12.0%	9.1%	7.4%	6.2%
Information and communication	3.2%	8.8%	10.1%	8.7%	7.9%	6.8%	6.6%
Education	0.3%	10.0%	11.0%	10.9%	9.5%	8.4%	6.7%

Source: (Rosstat).

Moving from a ten-year retrospective review to a today's situation (according to Rosstat, Table 1), note that, by activity, wholesale and retail trade are leading in a number of existing enterprises (38.4% of a total number), and a number of enterprise deaths (47.3% of a total number of dead enterprises). In this category, there is an almost even liquidation of enterprises aged 2-5 (9% each of age subcategories) and a higher survival rate of one-year enterprises, of which only 2.2% have been dissolved.

In general, a number of *young* enterprises prevails (10-12% of subcategories of enterprises aged 1-2 versus 6% of subcategories of enterprises aged 5). There is a similar situation in construction (12.5% of a total number of enterprises), manufacturing industries (8.2%), information and communication (3.2%) and education (0.3%). In these categories, those enterprises dominate (in number), incorporation of which had been not earlier than three years ago. Their gap from more mature actors in economy is 0.5-3 percentage points.

There is another picture in supplies of electricity, gas and steam (0.5% of a total number of enterprises) and this industry looks much more conservative. Here, a number of *young* businesses is less than a number of more mature ones. This, in 2017, in this category, there were 5.7% of enterprise registrations, while a number of legal entities aged 2-5 was 7.3-8.1%, respectively. At the same time, from enterprise deaths in this category, it is clear that this group is getting younger: there is a clear increase in a number of enterprise deaths in 2017 with an increasing age of the latter. Thus, in the subcategory of enterprise deaths, 1.4% of companies were aged one, 5.6% were aged three, and 8.1% were aged five. There is the most active youthification (advanced death of mature in the industry) in information and communications, manufacturing and mineral extraction.

**Table 2.** Enterprise deaths distributed by age in Russia in 2017

Economic activity / Indicator	Number of enterprise deaths	including				
		one-year	two-year	three-year	four-year	five-year
Total	100.0% 510669	2.4%	8.4%	8.5%	8.7%	8.2%
Extraction of mineral resources	0.3%	2.4%	6.4%	6.6%	6.4%	7.8%
Manufacturing industries	7.5%	1.5%	4.8%	6.2%	7.7%	7.8%
Supplies of electricity, gas and steam, air conditioning	0.4%	1.4%	4.4%	5.6%	6.8%	8.1%
Construction	12.4%	2.7%	9.5%	9.0%	8.9%	8.3%
Wholesale and retail trade,	47.3%	2.2%	9.2%	9.2%	9.1%	8.5%

Economic activity / Indicator	Number of enterprise deaths	including				
		one-year	two-year	three-year	four-year	five-year
repair of motor vehicles and motorcycles						
Information and communication	2.5%	2.3%	6.5%	7.0%	7.3%	7.5%
Education	0.3%	2.8%	8.4%	9.6%	8.7%	6.8%

Source: (Rosstat).

The next step is a study of short-term and long-term survival rates of Russian and EU enterprises. The tables present data on enterprise survival rates for two periods: the first year upon incorporation (comparison of 2014 and 2013, Table 3), and within 5 years from incorporation (companies operated in 2009-2014, Table 4).

**Table 3.** Survival rate 1\*: EU and Russian companies in 2014/2013

Economic activity / Region	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Construction	Wholesale and retail trade, repair of motor vehicles and motorcycles	Information and communication	Education
Czech Republic	64.29	73.16	48.99	62.41	62.27	65.44	70.05
Germany	80.00	79.31	79.92	75.84	78.47	77.36	79.96
Spain	65.96	79.71	83.50	68.23	73.52	78.44	81.35
France	78.85	85.31	70.83	75.00	82.11	79.28	82.12
Italy	85.42	86.04	81.69	69.70	79.77	82.13	86.89
Latvia	50.00	88.27	72.73	89.74	79.19	90.07	87.18
Lithuania	83.33	93.85	84.51	92.93	92.06	93.53	78.69
Luxembourg	100.00	94.87	50.00	91.85	88.58	91.60	87.50
Hungary	80.77	77.91	86.52	76.11	76.75	79.28	80.57
Netherlands	88.89	84.95	86.49	71.80	80.09	79.61	81.70
Austria	50.00	85.18	84.62	80.36	81.04	78.75	83.59
Poland	75.68	71.04	69.82	62.96	67.77	61.92	-
Portugal	87.88	90.56	92.31	88.11	89.09	91.54	91.16
Romania	66.20	73.32	54.55	67.64	72.97	85.16	87.78
Slovenia	100.00	87.96	94.12	85.61	84.95	85.31	87.93
Slovakia	45.45	55.00	22.22	50.94	53.76	41.92	40.93
Finland	69.23	74.75	80.49	73.18	75.62	79.17	74.87
Sweden	93.33	98.47	98.04	97.68	96.98	98.97	-
United Kingdom	72.09	92.85	78.83	94.35	94.69	95.08	94.36
Norway	63.27	77.47	56.41	78.62	76.83	73.17	91.40
Turkey	85.95	80.97	78.02	84.32	81.75	81.71	85.66
Russia**	75.40	74.80	83.40	68.80	65.80	73.20	81.30

Note:

\* Survival rate 1 is a number of enterprises in the reference period ( $t$ ) newly born in  $t-1$  having survived to  $t$  divided by the number of enterprise births in  $t-1$ , percentage;

\*\* Data conversion format for Russia '2013+1'.

Source: (Eurostat; Kuzmin, 2018).

The analysis of data on EU companies for 2014 assumes that Sweden, the United Kingdom, Luxembourg, Lithuania, Slovenia, and Portugal are absolute leaders by enterprise survival rate almost in all of the sectors. Sweden is number one in five industries (of seven in total) by enterprise survival rate, and ranks among top three in six industries (for the seventh industry, there are no data for Sweden). This indirectly assumes that Sweden has created the most favourable conditions for a launch of an enterprise. The United Kingdom and Lithuania (among top three by enterprise survival rate in four sectors) have the second position. In the UK, there is a high enterprise survival rate in such areas, as education, information technology, wholesale, construction, and manufacture. The

value is low in electric power and resource extraction, which are closely interconnected and this indirectly points out to a highly competitive environment in these areas. Luxembourg (traditionally high survival rate in all of the sectors except for electric power), Slovenia (high rates in all of the sectors), and Portugal (high rates in all of the sectors) share the third position on the rating by enterprise survival rate in the EU.

Not all among countries leading in the EU are at the same time countries with the highest GDP, or GDP per capita, assuming that the enterprise survival rate in the first year in this period was more likely dependent on comfortable business conditions instead of their economic development and an unsaturated competitive environment in some industries. The average survival rate for all industries in Sweden is 97.25%. The indicator of over 97% in the first year of operations was only in extraction industry in two countries (Luxembourg and Slovenia), equal to 100%, which was probably due to oligopoly in the market or an intensive government support. The survival data analysis confirms that for the period of  $t-5$ , when Slovenia also had the survival rate of 100% in this industry. The average survival rate in the first year was 77% in all of the countries and industries

Note also that in  $\frac{3}{4}$  of countries, over 75% of enterprises survive in the first year, while in a half of countries this value is over 79%. Production has become an industry with the highest enterprise survival rate in 2014 among other countries. The average value is 82.08%, while the least was 74.32% in education.

The average enterprise survival rate in Russia was 74.67% (for the period under review). Poland, Hungary, Norway and Spain had the same value. The enterprise survival rate of 65-75% is typical for one fourth of countries from the EU sample. *Russia is in the group of countries with the least enterprise survival rate in the first year of operations*, along with such countries, as Norway (73.88%), Romania (72.52%), Poland (68.20%), the Czech Republic (63.80%), and Slovakia (44.32%). Note that there is an extremely low enterprise survival rate in Slovakia, which is the last among seven industries with a minimum rate of 22.22% in electric power industry. In general, countries, enterprise average survival rates of which are low, in the first year upon incorporation, retain low ratings in almost all of the sectors. This means that trends in dynamics of enterprise sustainability depend on a general economic situation and a lack of support to recently incorporated enterprises instead of depending on specifics in a particular industry. This may also assume a high proportion of companies that resort to tax optimization and large number of *one-day companies*. Also, note that almost all of the countries with the low average enterprise survival are in Eastern Europe and their GDP is lower than that of other countries on the list. This might show a correlation and dependence between a level of economic development and enterprise sustainability nationwide.

**Table 4.** Survival rate 5\*: EU and Russian enterprises in 2014/2009

Economic activity / Region	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Construction	Wholesale and retail trade, repair of motor vehicles and motorcycles	Information and communication	Education
Czech Republic	47.06	46.43	25.71	34.82	39.69	48.13	42.35
Estonia	0.00	42.86	60.00	34.08	39.04	42.94	42.42
Spain	35.59	38.77	53.45	20.17	35.19	36.75	44.27
France	62.50	49.83	38.95	30.41	43.74	39.87	46.89
Italy	47.95	41.31	45.77	25.64	37.13	44.06	50.81
Latvia	47.06	45.74	36.96	33.28	37.51	48.77	65.15
Lithuania	85.71	64.89	63.16	63.83	66.83	70.96	66.79
Luxembourg	-	41.94	100.00	54.27	52.59	53.61	50.00
Hungary	22.58	32.36	23.40	25.50	30.00	29.00	23.15
Netherlands	33.33	47.53	45.00	34.38	45.28	41.75	46.63
Austria	50.00	54.40	58.23	49.75	47.13	43.49	50.36
Portugal	47.62	48.13	52.00	34.33	41.92	46.03	38.70

Economic activity / Region	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Construction	Wholesale and retail trade, repair of motor vehicles and motorcycles	Information and communication	Education
Romania	33.00	30.08	42.86	22.31	28.52	29.82	39.25
Slovenia	100.00	42.05	56.52	23.60	40.44	51.17	39.29
Russia**	56.00	50.70	63.00	49.10	38.70	63.80	67.10

Note:

\* Survival rate 5 is number of enterprises in the reference period (t) newly born in  $t-5$  having survived to  $t$  divided by the number of enterprise births in  $t-5$ , percentage;

\*\* Data conversion format for Russia '2009+5'.

Source: (Eurostat; Kuzmin, 2018).

The analysis of the five-year trend in 2009/2014 (Table 4) assumes that the average enterprise survival rate in all of the countries and industries was 44.93% (against 77% in the first year), i.e. 40% lower than in the first year. This means that, on average, in the EU and Russia, a half of enterprises does not achieve five years of operations. Although, these data do not cover a number of countries listed in Table 3. The analysis of data from such leading countries, as Lithuania, Luxembourg, Slovenia, and Portugal shows that the enterprise survival rate in these countries for 5 years declined from 19% to 46% respectively. *This confirms that 30–40% survival rate decline over five years is a norm.*

Note that in Russia, Lithuania, and the Czech Republic, the average survival rate of enterprises in all of the sectors decreased by a smallest percentage (19-23%). At the same time, in five-year aspect, Russia entered a range of top countries in terms of the average enterprise-survival rate in all of the sectors (55.49%, while Lithuania had a maximum survival rate of 68.88%). This might assume that a burden on enterprises in the first year (2009) was much higher than later. The global financial crisis of 2008-2009 in one way or another had a negative impact on economies of all companies and countries, so that positive and negative trends of the enterprise survival rate in several countries upon the crisis (in 2009-2014) one might only in part attribute to an economic situation. Indicators from Russia and the Czech Republic make it possible to conclude that in these countries a company, having survived the first year of operations, has greater chances to work longer than for five years.

The Czech Republic, Spain, Estonia, Romania, and Hungary had the least average survival rate in five years. At the same time, the enterprise survival rate in Hungary fell to a record of 53.13%. This means that more than a half of enterprises in Hungary had ceased operations. Industry-specific analysis in these countries confirms a retained general trend towards low survival rates of enterprises in the long term. It is revealing that extraction companies turned out to operate in the industry with the highest enterprise survival rate in all of the countries (survival rate of 47.74%), while construction had the lowest rate of 33.69%.

Findings from the completed data analysis show that in general the enterprise survival rate strongly depends on industry and country of operations. The enterprise survival rate gets significantly lower in five years, while a decline percentage depends more on internal trends in national business development instead of an economic situation. Another amazing observation was a high percentage of Russian enterprises that were unviable in their first year accompanied with a high percentage of enterprises operating for more than five years.

## 5. Discussion

Findings show that demography dynamics is a complex process where it is impossible to single out just one influence factor. Each country has its own reasons that precondition a focus of its entrepreneurial activity. However, it is possible to identify features typical for a business climate in Russia and in the EU. The main factor

of the enterprise survival rate in Russia is rapid adaptability to changes caused by uncertainty in an external environment and a high margin of safety/reserve against a possibility of economic or other shocks. Enterprise sustainability in the EU is typical for large-sized actors that actively benefit from economy of scale, innovate their production facilities and use export distribution channels for products. Depending on established conditions (as part of nature, climate and history related aspects and general economic, infrastructural, and institutional conditions), a level of entrepreneurship development will be highly differentiated and heterogeneous. Table 5 shows main differences in factors that influence the enterprise survival rate in Russia and the EU.

**Table 5.** Differences in factors that influence enterprise survival rates in Europe and Russia

Europe	Russia
High competition	Low competition
Low loan rates	High loan rates
High taxes for business	Low taxes for business
Large number of innovative companies	Small number of innovative companies
Poor government support to business	Government support to business
High role of exports and imports, inter-countries interaction	Difficulties in interaction with other countries
Large number of business angels and business incubators	Small number of business angels and business incubators
Open access to advanced technology	Difficulties in access to advanced technology
High research level	Poor research level
Large number of small and medium-sized enterprises	Large number of monopolies and large-scale enterprises (often government-funded)
Relatively stable macroeconomic environment	Relatively unstable macroeconomic environment

In theory of economy, there are two general groups of factors that influence both enterprise living in general and the survival rate in particular. Internal factors refer to factors that depend on a condition of an enterprise, its management system, available resources, etc. External factors refer to tax and credit control policy of a government, institutional and financial support, and external regional and global crises. Consider these features in more detail. The tax policy of the government is the first. One might assume that the lower a tax rate is, the more favourable demographic dynamics is and vice versa, but many researchers have found that there is no direct dependence between the enterprise survival rate and a value of the tax rate (Hungerford 2013; Jaimovich & Rebelo, 2017; Jones, 1999; Lucas, 1988). Dynamics and the tax rate value are not always directly proportional to business demography in the aspect of an influence, although there is such a correlation. It is possible to refer to France, Italy, Spain, Germany, etc., where a high fiscal burden goes hand in hand with a good demography survival rate in the first years upon incorporation.

The second most important environmental factor that influences the enterprise survival rate is the loan rate. Inflation expectations and availability of financial resources affect enterprise development opportunities, seriously restraining a growth of those actors that are limited in these aspects. Government support is another factor. For example, France has introduced incentives for a start of businesses in spite of the highest enterprise tax. We associate the relatively high birth rate in France with implementation of the corresponding government program (RSM International Association, 2014). However, empirical studies (Chindooroy, Muller & Notaro, 2007) lead us to a conclusion that among companies that benefit from a direct government support, there is a high death rate. At the same time, a volume of support and availability of other support tools do not either influence their survival, or this connection is poor. We can conclude that a limited and differentiated government support in a form of much favourable conditions created for entrepreneurship would consolidate a business environment and create necessary conditions for a growth by ensuring the survival of recently incorporated and existing enterprises.

As a result, it is possible to agree that an analysis of business demography gives a clear idea of difficulties in entrepreneurship development, whereas a comparison between regions that have various factorial effects provides opportunities for modelling tools of control over these trends.

## Conclusions

Survival is one of the main objectives when an enterprise develops its strategy regardless of its status and a stage in a life cycle. Adaptation to changes in internal and external environments is a core of economic sustainability, clearly manifested in the universal indicator of business demography, specific level of the enterprise survival. Industry and countries, in which enterprises operate, strongly influence enterprise survival rates.

Findings from this research assume that, to a certain extent, high birth and death rates in Russia depend on institutional conditions and a market condition (competition saturation, consumption recession, incorporation procedures, local changes in tax legislation, etc.). There is a clear medium-term trend towards a decline in a number of enterprise births and increase in a number of enterprise deaths in Russia. At the same time, a recent ratio between them has even become negative. There is an intensive rotation of companies in a number of industries: wholesale and retail trade, construction, manufacturing industries, education, information and communication. In these categories, in numbers, dominating companies have been those companies that had been *born* not earlier than three years ago.

The average enterprise survival rate in Russia was 74.67% over the period in question. Poland, Hungary, Norway and Spain have the same value. The enterprise survival rate of 65-75% is typical for one fourth of countries from the EU sample. Thus, Russia is in the group of countries with the least enterprise survival rate in the first years of their operations. The discussed five-year trend of 2009-2014 assumes that the average enterprise survival rate in all countries and industries was 44.93% (versus 77% in the first year). This means that, on average, in the EU and Russia, a half of enterprises does not operate for five or more years. This confirms that a decrease in the survival rate by 30–40% over five years is normal. It is amazing that in Russia, the average enterprise survival rate in all sectors has had the smallest decline of 19-23%. At the same time, in the five-year trend, Russia have entered the group of top countries in terms of the average enterprise survival rate in all of the sectors (55.49%). This might assume that a load on enterprises in the first year was significantly higher than later.

In general, countries with a low average enterprise survival rate in the first year have a low rating in almost all of the industries. This assumes that trends in dynamics of enterprise sustainability depend on an overall economic situation instead of the specifics in a particular sector. These features assume available self-organizing skills developed by Russian companies when they adjust to shocks of environmental uncertainty, fixed in a long-term memory effect. At the same time, EU companies did not show such features in their functioning, but, on the contrary, their short-term sustainability was higher than a long-term one.

## Aknowledgements

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## References:

- Adizes, I. (1979). Organizational passages – diagnosing and treating lifecycle problems of organizations. *Organizational Dynamics*, 8(1), 3–25. [https://doi.org/10.1016/0090-2616\(79\)90001-9](https://doi.org/10.1016/0090-2616(79)90001-9)
- Aldrich, H., & Auster, E. (1986). Even dwarfs started small: liabilities of size and age and their strategic implications. *Research in Organizational Behavior*, 8, 165–198.



- Armington, C., & Acs Z.J. (2002). The determinants of regional variations in new firm formation. *Region Stud* 35, 33–45. <https://doi.org/10.1080/00343400120099843>
- Beugelsdijk, S., Klasing, M.J., & Milionis, P. (2018). Regional economic development in Europe: the role of total factor productivity. *Regional Studies*, 52(4), 461–476. <https://doi.org/10.1080/00343404.2017.1334118>
- Braunerhjelm, P. (2010). *Entrepreneurship, innovation and economic growth: past experiences, current knowledge and policy implications* (Working Paper Series in Economics and Institutions of Innovation 224, Royal Institute of Technology, CESIS - Centre of Excellence for Science and Innovation Studies). Retrieved from <http://www.entreprenorskapsforum.se>
- Bruderl, J., & Schussler, R. (1990). Organizational mortality: the liabilities of newness and adolescence. *Administrative Science Quarterly*, 35, 530–547. <https://doi.org/10.2307/2393316>
- Capello, R. (2010). Space, growth and development. In R. Capello, & P. Nijkamp (Eds.), *Handbook of Regional Growth and Development Theories*. Edward Elgar Publishing.
- Capello, R. (2011). Location, regional growth and local development theories. *AESTIMUM*, 58, 1–25.
- Chindooroy, R., Muller, P. & Notaro, G. (2007). Company survival following rescue and restructuring State aid. *European Journal of Law and Economics*, October, 24(2), 165–186. <https://doi.org/10.1007/s10657-007-9031-9>
- Concerning structural business statistics. (2008) (Regulation No. 295/2008 of the European Parliament and the Council). Retrieved from <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:097:0013:0059:EN:PDF>
- Crescenzi, R., Luca, D., & Milio, S. (2016). The geography of the economic crisis in Europe: national macroeconomic conditions, regional structural factors and short-term economic performance. *Cambridge Journal of Regions, Economy and Society*, 9(1), 13–32. <https://doi.org/10.1093/cjres/rsv031>
- Ernst & Young, Russian Venture Company. (2014). *Problems and solutions: business incubators and technology parks in Russia*. Moscow. Retrieved from [https://www.rvc.ru/upload/iblock/f7d/201403\\_Business\\_incubators.pdf](https://www.rvc.ru/upload/iblock/f7d/201403_Business_incubators.pdf)
- Eurostat. Business demography. Retrieved from <https://ec.europa.eu/eurostat/web/structural-business-statistics/entrepreneurship/business-demography>
- Federico, J.S., & Capelleras, J.L. (2015). The heterogeneous dynamics between growth and profits: the case of young firms. *Small Business Economics*, February, 44(2), 231–253. <https://doi.org/10.1007/s11187-014-9598-9>
- Fertala, N. (2008). The shadow of death: do regional differences matter for firm survival across native and immigrant entrepreneurs? *Empirica*, 35(1), 59–80. <https://doi.org/10.1007/s10663-007-9051-2>
- Garnsey, E., Stam, E., & Heffernan, P. (2006). New firm growth: Exploring processes and paths. *Small Business Economics*, 13(1), 1–20.
- Gerguri, S., & Ramadani, V. (2010). *The Impact of innovation into the economic growth* (MPRA Paper No. 22270). Retrieved from <https://mpa.ub.uni-muenchen.de/22270>
- Gerlach, K., & Wagner, J. (1994). Regional differences in small firm entry in manufacturing industries: Lower Saxony, 1979–1991. *Entrepreneurship & Regional Development*, 6(1), 63–80. <https://doi.org/10.1080/08985629400000004>
- Hannan, M., & Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, 49, 149–164. <https://doi.org/10.2307/2095567>
- Harris, R. & Robertson, C. (2001). *The impact of regional selective assistance on UK manufacturing and total factor productivity. 1990-98* (Paper presented at CEPR/ESRC Workshop. London).
- Hungerford, T.L. (2013). Corporate tax rates and economic growth since 1947 (Issue brief No. 364). Economic Policy Institute. Retrieved from <http://www.epi.org>
- International Fund of Support to Economic Reforms in Russia. (1994). *Proceedings of the 3<sup>rd</sup> International Congress “Small and Medium-sized Business in Russia”*, Moscow, Russia (November, 23-25).



- Ivonen, L.A., & Shirokova, G.V. (2016). Strategic entrepreneurship: essence and main research directions. *Vestnik of Saint Petersburg University. Ser. 8. Management*, 4, 21–53.
- Jaimovich, N. & Rebelo, S. (2017). Non-linear Effects of Taxation on Growth. *Journal of Political Economy*, 125(1), 265–291. <https://doi.org/10.1086/689607>
- Jones, C.I. (1999). Growth: With or Without Scale Effects? *American Economic Review*, 89, 139–44. <https://doi.org/10.1257/aer.89.2.139>
- Knight, F.H. (1965). *Risk, Uncertainty and Profit*. New York.
- Krugman, P. (1991). *Geography and Trade*. Massachusetts: MIT Press.
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, 99, 483–499. <https://doi.org/10.1086/261763>
- Kuzmin, E.A. (2018). Data on empirically estimated enterprise survival rate in Russia. *Data in brief*, 16, 850–864. <https://doi.org/10.1016/j.dib.2017.12.011>
- Kuzmin, E.A. (2017). *Empirical estimator of corporate survival rate in Russia: regional survey for 1991-2014*. North Charleston, USA: CreateSpace.
- Kuzmin, E.A. (2018). *Empirical estimator of corporate survival rate in Russia: branch-wise survey for 1991-2014*. North Charleston, USA: CreateSpace.
- Kuzmin, E.A., Guseva, V.E. (2016). Survival rate and lifecycle in terms of uncertainty: review of companies from Russia and Eastern Europe. *Journal of Advanced Research in Law and Economics*, 7(21), 1754–1766.
- Kuzminov, A.N., Abdullayev, R.R., & Shirokov, I.O. (2016). Research tools of industrial economy in the context of business structures survival. *Accounting and Statistics*, 1, 108–114.
- Kuznetsov, D.E. (2017). Survival of the Russian companies in export. *Russian Journal of Entrepreneurship*, 18(1), 57–66.
- Lucas, R.E., Jr. (1978). On the Size Distribution of Business Firms. *The Bell Journal of Economics*, 9, 508–23. <https://doi.org/10.2307/3003596>
- Lucas, R.E., Jr. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Mata J., & Portugal, P. (2002). The survival of new domestic and foreign-owned firms. *Strategic Management Journal* 23, 323–343. <https://doi.org/10.1002/smj.217>
- Melitz, M. (2003). The Impact of Trade on Intra-Industry reallocation and Aggregate Industry Productivity. *Econometrica*, 71(6), 1695–1725. <https://doi.org/10.1111/1468-0262.00467>
- Müller, Al., & Pflieger, R. (2014). Business transformation towards sustainability. *Business Research*, 7(2), 313–350. <https://doi.org/10.1007/s40685-014-0011-y>
- Myrdal, G. (1957). *Economic Theory and Underdeveloped Regions*. London: Duckworth.
- OECD. *The OECD-Eurostat entrepreneurship indicators programmer: background information*. Retrieved from: <http://www.oecd.org/sdd/business-stats/theentrepreneurshipindicatorsprogrammeeipbackgroundinformation.htm>
- Plummer, L.A., & Pe'er, A. (2010). The geography of entrepreneurship. In: Z. Acs & D. Audretsch (Eds.), *Handbook of entrepreneurship research. International handbook series on entrepreneurship*, 5 (pp. 519–556). New York, NY: Springer. [https://doi.org/10.1007/978-1-4419-1191-9\\_19](https://doi.org/10.1007/978-1-4419-1191-9_19)
- Porter, M. E. (2000). Location, clusters, and company strategy. In G. Clark, M. Feldman, & M. Gertler (Eds.), *Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.

- Prakash, R., & Garg, P. (2019). Comparative assessment of HDI with Composite Development Index (CDI). *Insights into Regional Development*, 1(1), 58-76. [https://doi.org/10.9770/ird.2019.1.1\(5\)](https://doi.org/10.9770/ird.2019.1.1(5))
- Preisendörfer, P., & Voss, T. (1990). Organizational Mortality of Small Firms: The Effects of Entrepreneurial Age and Human Capital, *Organization Studies*, 11(1), 107–129. <https://doi.org/10.1177/017084069001100109>
- Reiner, C. & Gassler, H. (2017). *Where are the entrepreneurs when we need them?* (LBS Working Paper 3). Vienna.
- Richardson, H.W. (1973). *Regional Growth Theory*. London. <https://doi.org/10.1007/978-1-349-01748-5>
- Romer, P. (1992). *Increasing Returns and New Developments in the Theory of Growth* (NBER Working paper).
- Rossetti, F. (2017). *The Business demography of the ICT sector in Europe* (No. JRC106589). Joint Research Centre (Seville site).
- Rosstat. *Institutional Changes in Economy: Business Demography*. Retrieved from [http://www.gks.ru/wps/wcm/connect/rosstat\\_main/rosstat/ru/statistics/enterprise/reform](http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/enterprise/reform)
- Rosstat. *Statistical Methodology to Generate Indicators of Business Demography (in Terms of Legal Entities)* (approved by Order No. 541 on August 29, 2014). Retrieved from: [http://www.gks.ru/free\\_doc/new\\_site/business/inst-preob/metodika\\_bizn-dem.doc](http://www.gks.ru/free_doc/new_site/business/inst-preob/metodika_bizn-dem.doc)
- RSM International Association. (2014). *Recovery of global economy: Conclusions from an international comparative study of “birth” and “death” rates of enterprises*. Retrieved from: <http://www.rsmrus.ru>
- Sasongko, G., Huruta, A.D., & Wardani, A. (2019). Does the Wagner’s Law exist in a strategic national area? An evidence from Kedungsepur – Indonesia. *Insights into Regional Development*, 1(2), 99-117. [https://doi.org/10.9770/ird.2019.1.2\(2\)](https://doi.org/10.9770/ird.2019.1.2(2))
- Schouten, M.J. (2019). Undoing gender inequalities: insights from the Portuguese perspective. *Insights into Regional Development*, (2), 85-98. [https://doi.org/10.9770/ird.2019.1.2\(1\)](https://doi.org/10.9770/ird.2019.1.2(1))
- Schumpeter, J.A. (1961). *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*. New York: OUP.
- Shamrai, A.A. (Ed.). (2010). *Life Cycle of a Small Enterprise*. Moscow: Liberal Mission Foundation.
- Shirokova, G.V., Merkurieva, I.S., & Serova, O.Yu. (2006). Features of the formation of the life cycles of Russian companies (empirical analysis). *Russian Management Journal*, 4(3), 3–26.
- Simonova, L.M., & Ovsiyankina, M.V. (2016). Demography of Organization as a Navigator of Management’s Decision Making. *Tyumen State University Herald. Social, Economic, and Law Research*, 2(2), 209–218. <https://doi.org/10.21684/2411-7897-2016-2-2-209-218>
- Solow, R.A. (1956). Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, 70, 65–94. <https://doi.org/10.2307/1884513>
- Sombart, W. (1913). *Studien zur Entwicklungsgeschichte des modernen Kapitalismus*. München/Leipzig: Duncker & Humblot.
- Stinchcombe, A.L. (1965). Social structure and organizations. In J.P. March (Ed.), *Handbook of Organization* (pp. 142-193). Chicago: Rand McNally.
- Swan, T. (1956). Economic Growth and Capital Accumulation. *Economic Record*, 32(2), 334–361. <https://doi.org/10.1111/j.1475-4932.1956.tb00434.x>
- The Community Lisbon Program. (2005). Communication from the Commission to the Council and the European Parliament. Common actions for growth and employment. Brussels.
- Tobias, H., & Scheermesser, M. (2006). Approaches to corporate sustainability among German companies. *Corporate Social and Responsible Environmental Management*, 13(3), 150–165. <https://doi.org/10.1002/csr.100>
- Tödtling, F., & Wanzenböck, H. (2003). Regional differences in structural characteristics of start-ups. *Entrepreneurship & Regional Development*, 15(4), 351–370. <https://doi.org/10.1080/0898562032000058923>

Tvaronavičienė, M., & Gatautis, R. (2017). Peculiarities of income distribution in selected countries. *Economics and Sociology*, 10(4), 113-123. <https://doi.org/10.14254/2071-789X.2017/10-4/9>

Van Praag, C.M. (2003). Business Survival and Success of Young Small Business Owners. *Small Business Economics*, 21(1), 1–17. <https://doi.org/10.1023/A:1024453200297>

Volkonitskaya, E.M. (2006). The governmental registration of business organizations: a comparative analysis of legislation of European countries and Russia. *Omsk Scientific Bulletin*, 10(49), 69–74.

Wennekers S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics*, 13(1), 27–56. <https://doi.org/10.1023/A:1008063200484>

Zeibote, Z., Volkova, T., & Todorov, K. (2019). The impact of globalization on regional development and competitiveness: cases of selected regions. *Insights into Regional Development*, 1(1), 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))

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Open Access

## ARE THE MOTIVATIONAL PREFERENCES OF EMPLOYEES WORKING IN SMALL ENTERPRISES IN SLOVAKIA CHANGING IN TIME?\*

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**Abstract.** Small and medium-sized enterprises constitute a significant part of Slovakia's economy with the greatest potential for growth and the impact on economic stabilization and balanced development of the regions. The employee motivation has a major impact on the performance of employees working in these businesses. Research focused on the exploration of employee motivational preferences was conducted in all regions of Slovakia in 2017 and 2018. The sociological survey method was used through anonymous questionnaires. Overall, 2,646 respondents participated in the research. Based on the research results, it can be stated, that motivational preferences of employees working in small enterprises in Slovakia are changing over time. These are primarily motivational factors relating to the social needs and financial motivational factors.

**Keywords:** employee motivation; small and medium-sized enterprises; Slovakia

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**JEL Classifications:** J24, M12, O15

### 1. Introduction and theoretical background

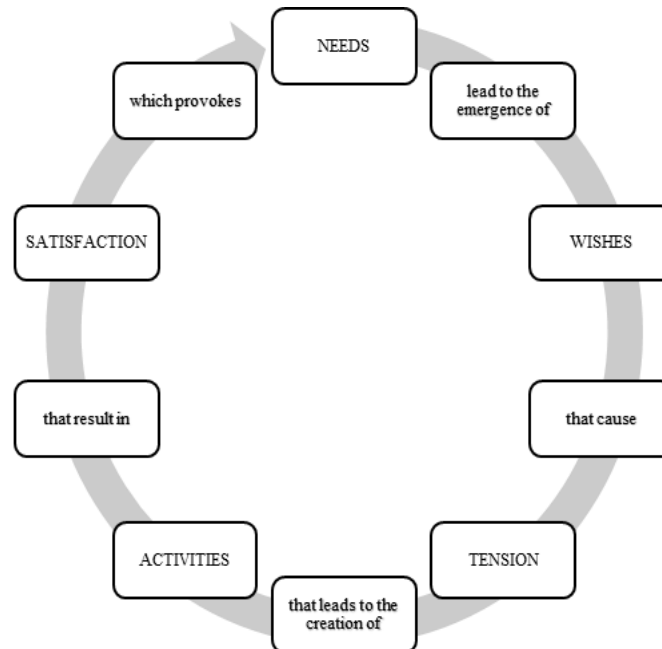
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Established by the European Commission

Small and medium-sized enterprises (SMEs) constitute a significant part of Slovakia's economy with the greatest potential for growth and the impact on economic stabilization and balanced development of the regions (Marková et al. 2016; Lesáková et al. 2017; Mura et al. 2018). In Slovakia, SMEs present 99.9% of the total number of business entities. They offer a number of benefits that large companies are not usually able to provide. The most important are their flexibility, quick response to changes in the environment, ease of decision making, and high market focus (Altinay et al. 2016; Němec et al. 2017; Prange et al. 2017; Sertic et al. 2018; Žul'ová et al. 2018). They also provide employment opportunities for almost three quarters of the active workforce and contribute more than half to creating added value. Thanks to their rapid adaptation to the changing environment and customer needs, small businesses are the carriers of many small innovations (Georgiadis et al. 2012; Jonec et al. 2013; Havierníková et al. 2017; Carreras et al. 2018; Kovalova et al. 2018; Mura & Mazák, 2018). In 2017, the small and medium-sized enterprise (SME) sector developed under conditions of increasing performance of the Slovak economy. Almost all main indicators characterizing the development of SMEs recorded a positive development. SMEs recorded increased employment (+ 1.4%), added value (+ 8.9%), or profit (+ 7.5%), while value added growth in the SME sector was the most significant within the last seven years. However, in the foreign trade area, improvement has not been achieved in the SME sector (Slovak Business Agency 2018).

The performance of these businesses is affected by a number of specific processes (Lesáková 2012; Bielíková et al. 2014; Diaz-Fernandez et al. 2015; Poliacikova 2015; Salyova et al. 2015; Straková et al. 2016; Malá et al. 2017; Musa et al. 2017; Ližbetinová 2017; Urbancova et al. 2017; Aydın et al. 2018; Matraeva et al. 2018; Schouten, 2019). One of them is employee motivation, which is considered a powerful tool to strengthen and trigger the employee's desire to work (Dobre 2013; Cseh Papp et. al., 2018). It is the willingness of the individual to make a special effort to achieve the stated goal and at the same time the willingness of the employee to spend the necessary time to achieve this goal. Weihrich and Koontz (1993) perceive motivation as a cycle where, initially, there is a sense of need that creates wishes. They stimulate the creation of activities that are aimed at fulfilling the desired wishes, which again creates space for the emergence of new needs.



**Fig.1.** Chain: Need – Desire – Satisfaction

Source: Koontz et al. 1993

Denhardt et al. (2013) are of the opinion that if there is a sufficient number of employees in the company who are willing to work more than expected, then they will achieve higher performance. At the same time, employees are willing to work as long as they know their work performance will be appreciated. According to recent studies (Grossbart 2006; Campbell et al. 2007; Christianson et al. 2008; Eisenberger et al. 2009; Van Herck et al. 2010; Xu et al. 2017), one of the most used motivational factors that is used in practice is money. In addition, the research carried out by Al-Belushi et al. (2017) was also focused on the importance of monetary rewarding as a motivational factor. The results show that, in the opinion of 76.1% of respondents, the financial stimulus is important. It also follows from the cited research that 73.9% of the respondents stated that the wage affects their motivation. Most respondents agree that attractive pay increases their motivation to work. Research has further shown that monetary motivation has a direct impact on the willingness to achieve higher performance. This is confirmed by the research of Kuranchie-Mensah et al. (2016), Carr et al. (2017), Haar et al. (2018), Mészáros (2018) and Chang et al. (2018), which suggest that wages can have a positive impact on an employee's internal motivation by promoting autonomy and self-reliance. In many cases, however, managers make the most common mistake. They mistakenly think that every employee is motivated only by money.

According to Herzberg (1987), the basis of successful motivation is praise, which should come at a reasonable distance from the praised performance, always in an adequate manner that is in compliance with the attributes of praise. In order to praise in an effective way, it should not be repeated as it degrades its value. The importance of praise is confirmed by the research by Al Tareq et al. (2017). Authors say that praise will strengthen the position and recognition of the employee in the enterprise, which results in an increasing motivation to work. The same findings are presented by Belohlavek et al. (2003), based on the research, the awareness of success encourages and delivers a new taste and thrill. The importance of feedback on a fair assessment of employee performance is highlighted by Kozjek and Ovsenika (2017). Research results also show that feedback (without monetary reward) has a significant motivational effect on the employee and leads to long-term motivation. According to Al-Belushi et al. (2017), the growth of employees towards professional development leads to increasing performance and motivation of employees. Current research studies (Kropivšek et al. 2011; Fakhrutdinova et al. 2013; Damij et al. 2015; Kamasheva et al. 2015; Minarova 2015; Ližbetinová et al. 2016; Myint et al. 2016; Vetráková et al. 2016; Wang 2016; Pingping 2017; Bogdanović et al. 2018; Borisov et al. 2018) have shown that there is a number of factors that motivate employees. At the same time, however, the set of motivational factors is changing in time, this happens due to knowledge, age, education, experience, environment and so on (Armstrong 2007). In this context, it is the task of managers to choose such an m program that appropriately ensures maximum performance of employees.

## **2. Materials and methods**

Research focused on the exploration of employee motivational preferences was conducted in all regions of Slovakia in 2017 and 2018. The sociological survey method through anonymous questionnaires was used. Using the random selection method, questionnaires were distributed to employees working in small enterprises.

European Commission Recommendation No. 2003/361/EC defines a small enterprise as an enterprise which employs fewer than 50 persons and whose annual turnover and /or annual balance sheet total does not exceed EUR 10 million.

Total of 1,227 respondents participated in the research in 2017. In 2018, a total of 1,419 respondents participated in the research. A more detailed structure of the research sample is presented in Table 1.



**Table 1.** Structure of the research sample

Data to identify respondents	2017		2018	
	Absolute frequency	Relative frequency	Absolute frequency	Relative frequency
<b>Gender</b>				
Male	705	57.46	827	58.28
Female	522	42.54	592	41.72
<b>Age</b>				
Up to 30 years	268	21.84	237	16.70
31-40 years	432	35.21	435	30.66
41-50 years	366	29.83	423	29.81
51 years and more	161	13.12	324	22.83
<b>Completed education</b>				
Primary	33	2.69	21	1.48
Lower secondary	212	17.28	177	12.47
Upper secondary	634	51.67	686	48.34
Higher	348	28.36	535	37.71
<b>Seniority</b>				
Less than 1 year	114	9.29	81	5.71
1-3 years	338	27.55	288	20.30
4-6 years	300	24.45	336	23.68
7-9 years	227	18.50	252	17.76
10 years and more	248	20.21	462	32.55

Source: Own research

Respondents used a five-point rating scale (5 = very important, 4 = important, 3 = medium important, 2 = less important, 1 = unimportant). 30 motivational factors shown in Table 2 were evaluated. For reasons of not influencing the respondents, motivational factors were arranged alphabetically.

**Table 2.** The analyzed motivational factors

No.	Motivational factors	No.	Motivational factors
1.	Atmosphere in the workplace	16.	Prestige
2.	Good work team	17.	Supervisor's approach
3.	Fringe benefits	18.	Individual decision-making
4.	Physical effort at work	19.	Selfactualization
5.	Job security	20.	Social benefits
6.	Communication in the workplace	21.	Fair appraisal system
7.	Name of the company	22.	Stress
8.	Opportunity to apply one's own ability	23.	Mental effort
9.	Workload and type of work	24.	Mission of the company
10.	Information about performance result	25.	Region's development
11.	Working hours	26.	Personal growth
12.	Work environment	27.	Relation to the environment
13.	Job performance	28.	Free time
14.	Career advancement	29.	Recognition
15.	Competences	30.	Base salary

Source: Own research

Due to the scope and independence of the sample sets, we tested the zero hypothesis on average equivalence values of motivational preferences according to time (year 2017 and 2018) using the dual choice t-test for independent selections. Basic statistical characteristics were calculated for each motivational factor. These include information about the properties of the basic researched sets using fewer numeric data. In addition to the simple comparison of the values of the basic characteristics, due to the selective character of the obtained data, the conformity of the arithmetic means was tested. In the Student's t-test, we examined the significance of differences in the arithmetic mean of the individual motivational factors in the monitored enterprises so that it was excluded at the chosen level of significance  $\alpha$  that the observed differences between the arithmetic mean were not due solely to the representation error. Each motivational factor was summarily described by the basic characteristics of the level and variability of the quantitative features – the arithmetic mean  $\bar{x}$ , the standard deviation  $s_x$  and the coefficient of variation. Consequently, the results were compared. Testing was performed at the significance level  $\alpha = 0.05$ . Then a working hypothesis was defined:

- WH<sub>1</sub> – We assume that motivational preferences of employees working in small enterprises in Slovakia do not change over time.

As a test criterion, a random variable  $t$  was used which had Student's t distribution in the form:

- if  $\mu_{12} = \mu_{22}$ ;  $X_1$  and  $X_2$  are independent

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{n_1 \cdot s_1^2 + n_2 \cdot s_2^2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2}{n_1 \cdot n_2}}}$$

- if  $\mu_{12} \neq \mu_{22}$ ;  $X_1$  and  $X_2$  are independent

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1 - 1} + \frac{s_2^2}{n_2 - 1}}}$$

Subsequently, using cluster analysis, Euclidean distance (Triola 1989; Mason et al. 1990; Scheer et al. 2014) the similar groups of motivational factors preferred by employees working in small enterprises in Slovakia are identified. The Euclidean distance is given:

$$(x_1, x_2) = \sqrt{\sum_{i=1}^n (x_{1i} - x_{2i})^2}$$

where:

- $x_{1i}$  – the value of the i-th variable on the object 1
- $x_{2i}$  – the value of the i-th variable on the object 2
- $n$  – number of variables.

Subsequently, the second working hypothesis was defined:

- WH<sub>2</sub> – We assume that the groups of motivational factors preferred by employees working in small enterprises in Slovakia do not change over time.

### 3. Results and discussion

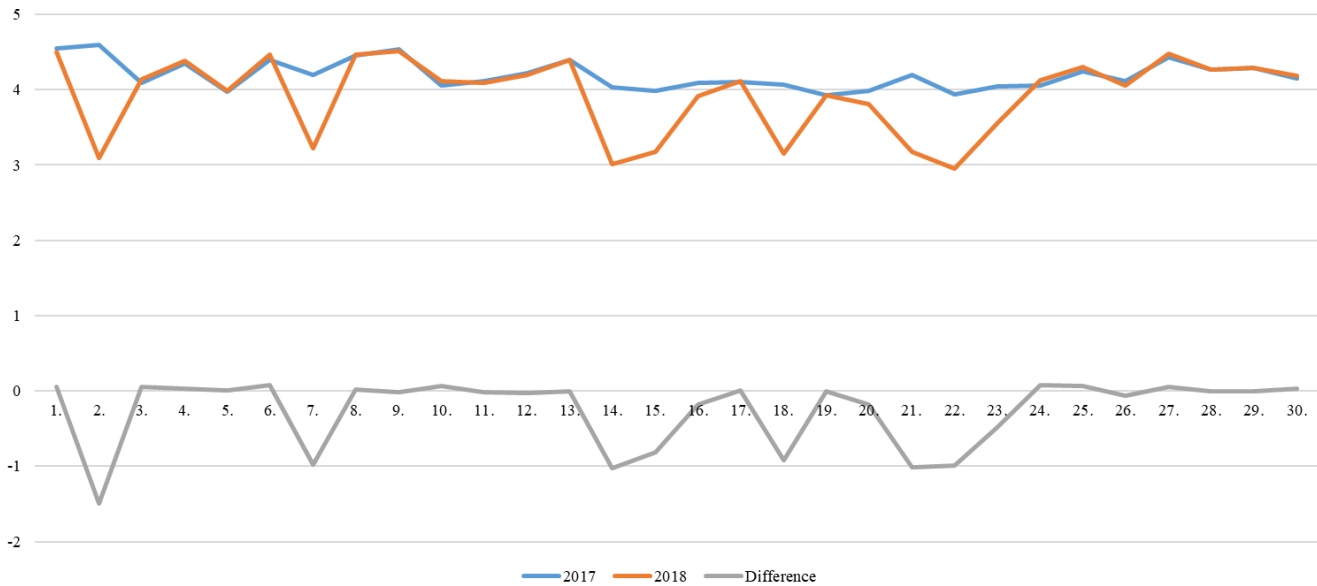
When comparing the level of motivational preferences of employees working in small enterprises in 2017 and 2018, we can see changes in the order of the average values of the analyzed motivational factors (Table 3). Overall, there is a decrease in the level of employee motivational preferences in 2018 (Figure 2).

**Table 3.** Ranking of the importance of motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018

No.	Motivational factors	2017	Motivational factors	2018
1.	Base salary	4.59	Good work team	4.51
2.	Atmosphere in the workplace	4.55	Atmosphere in the workplace	4.50
3.	Good work team	4.53	Supervisor's approach	4.48
4.	Fringe benefits	4.45	Fringe benefits	4.47
5.	Supervisor's approach	4.43	Fair appraisal system	4.47
6.	Job security	4.40	Job security	4.39
7.	Fair appraisal system	4.39	Communication in the workplace	4.38
8.	Communication in the workplace	4.35	Social benefits	4.30
9.	Working hours	4.29	Working hours	4.29
10.	Work environment	4.26	Work environment	4.26
11.	Social benefits	4.24	Job performance	4.19
12.	Job performance	4.22	Workload and type of work	4.18
13.	Free time	4.20	Career advancement	4.14
14.	Recognition	4.19	Selfactualization	4.13
15.	Workload and type of work	4.15	Opportunity to apply one's own ability	4.11
16.	Information about performance result	4.11	Individual decision-making	4.11
17.	Stress	4.11	Information about performance result	4.09
18.	Opportunity to apply one's own ability	4.10	Stress	4.05
19.	Name of the company	4.09	Competences	3.98
20.	Career advancement	4.09	Physical effort at work	3.92
21.	Personal growth	4.07	Name of the company	3.91
22.	Individual decision-making	4.05	Prestige	3.81
23.	Selfactualization	4.05	Relation to the environment	3.55
24.	Relation to the environment	4.04	Free time	3.22
25.	Mental effort	4.03	Recognition	3.18
26.	Prestige	3.99	Mission of the company	3.17
27.	Mission of the company	3.99	Personal growth	3.15
28.	Competences	3.97	Base salary	3.09
29.	Region's development	3.94	Mental effort	3.01
30.	Physical effort at work	3.93	Region's development	2.95

Source: Own research

Table 4 further defines the frequency of the analyzed samples, the average values of the motivational preferences in 2017 and 2018, the standard deviation and the p-level. Statistically significant differences are highlighted in bold. Significant changes in motivational preferences ( $p < 0.05$ ) occur with factors such as name of the company, prestige, selfactualization, fair appraisal system, mental effort, mission of the company, region's development, personal growth, relation to the environment, free time, recognition and base salary. Figures 3 to 14 illustrate significantly different motivational preferences.



**Fig.2.** Comparison of motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018

Source: Own research

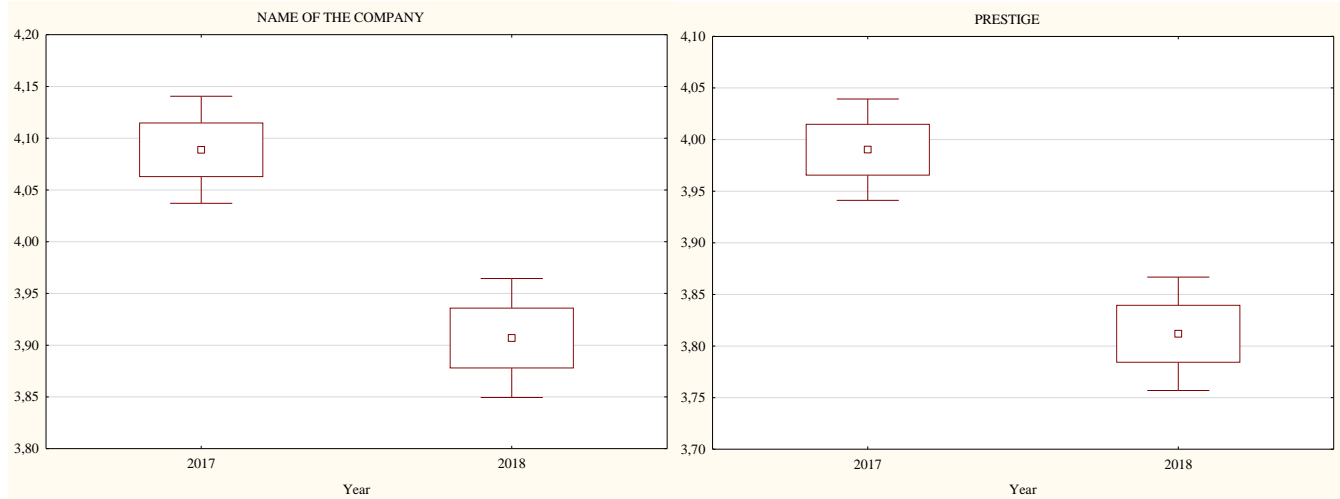
**Table 4.** Testing of motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018

Motivational factors	N 2018	N 2017	$\bar{x}$ 2018	$\bar{x}$ 2017	$s_x$ 2018	$s_x$ 2017	t	$d_f$	p-level
Atmosphere in the workplace	1419	1227	4.50	4.55	0.72	0.67	1.68	2644	0.093
Good work team	1419	1227	4.51	4.53	0.73	0.68	0.85	2644	0.397
Fringe benefits	1419	1227	4.47	4.45	0.75	0.75	-0.57	2644	0.571
Physical effort at work	1419	1227	3.92	3.93	0.92	0.98	0.47	2644	0.641
Job security	1419	1227	4.39	4.40	0.81	0.78	0.39	2644	0.699
Communication in the workplace	1419	1227	4.38	4.35	0.81	0.76	-1.04	2644	0.300
<b>Name of the company</b>	<b>1419</b>	<b>1227</b>	<b>3.91</b>	<b>4.09</b>	<b>1.11</b>	<b>0.93</b>	<b>4.55</b>	<b>2644</b>	<b>0.000</b>
Opportunity to apply one's own ability	1419	1227	4.11	4.10	0.85	0.89	-0.27	2644	0.786
Workload and type of work	1419	1227	4.18	4.15	0.84	0.83	-0.72	2644	0.471
Information about performance result	1419	1227	4.09	4.11	0.92	0.89	0.66	2644	0.509
Working hours	1419	1227	4.29	4.29	0.86	0.82	-0.08	2644	0.933
Work environment	1419	1227	4.26	4.26	0.85	0.77	0.22	2644	0.826
Job performance	1419	1227	4.19	4.22	0.82	0.83	0.86	2644	0.389
Career advancement	1419	1227	4.14	4.09	0.84	0.88	-1.41	2644	0.159
Competences	1419	1227	3.98	3.97	1.00	0.91	-0.35	2644	0.726
<b>Prestige</b>	<b>1419</b>	<b>1227</b>	<b>3.81</b>	<b>3.99</b>	<b>1.06</b>	<b>0.88</b>	<b>4.68</b>	<b>2644</b>	<b>0.000</b>
Supervisor's approach	1419	1227	4.48	4.43	0.82	0.77	-1.82	2644	0.069
Individual decision-making	1419	1227	4.11	4.05	0.89	0.85	-1.78	2644	0.075
<b>Selfactualization</b>	<b>1419</b>	<b>1227</b>	<b>4.13</b>	<b>4.05</b>	<b>0.87</b>	<b>0.86</b>	<b>-2.47</b>	<b>2644</b>	<b>0.014</b>
Social benefits	1419	1227	4.30	4.24	0.80	0.84	-1.61	2644	0.108
<b>Fair appraisal system</b>	<b>1419</b>	<b>1227</b>	<b>4.47</b>	<b>4.39</b>	<b>0.75</b>	<b>0.80</b>	<b>-2.60</b>	<b>2644</b>	<b>0.009</b>
Stress	1419	1227	4.05	4.11	0.95	0.88	1.65	2644	0.099
<b>Mental effort</b>	<b>1419</b>	<b>1227</b>	<b>3.01</b>	<b>4.03</b>	<b>1.08</b>	<b>0.90</b>	<b>26.28</b>	<b>2644</b>	<b>0.000</b>
<b>Mission of the company</b>	<b>1419</b>	<b>1227</b>	<b>3.17</b>	<b>3.99</b>	<b>0.98</b>	<b>0.93</b>	<b>21.75</b>	<b>2644</b>	<b>0.000</b>
<b>Region's development</b>	<b>1419</b>	<b>1227</b>	<b>2.95</b>	<b>3.94</b>	<b>1.04</b>	<b>0.99</b>	<b>25.10</b>	<b>2644</b>	<b>0.000</b>

<b>Personal growth</b>	<b>1419</b>	<b>1227</b>	<b>3.15</b>	<b>4.07</b>	<b>1.11</b>	<b>0.92</b>	<b>23.00</b>	<b>2644</b>	<b>0.000</b>
<b>Relation to the environment</b>	<b>1419</b>	<b>1227</b>	<b>3.55</b>	<b>4.04</b>	<b>1.13</b>	<b>1.00</b>	<b>11.74</b>	<b>2644</b>	<b>0.000</b>
<b>Free time</b>	<b>1419</b>	<b>1227</b>	<b>3.22</b>	<b>4.20</b>	<b>1.12</b>	<b>0.87</b>	<b>24.98</b>	<b>2644</b>	<b>0.000</b>
<b>Recognition</b>	<b>1419</b>	<b>1227</b>	<b>3.18</b>	<b>4.19</b>	<b>1.06</b>	<b>0.86</b>	<b>26.52</b>	<b>2644</b>	<b>0.000</b>
<b>Base salary</b>	<b>1419</b>	<b>1227</b>	<b>3.09</b>	<b>4.59</b>	<b>1.17</b>	<b>0.72</b>	<b>39.11</b>	<b>2644</b>	<b>0.000</b>

*Note: Statistically significant motivational factors are highlighted in bold.*

Source: Own research

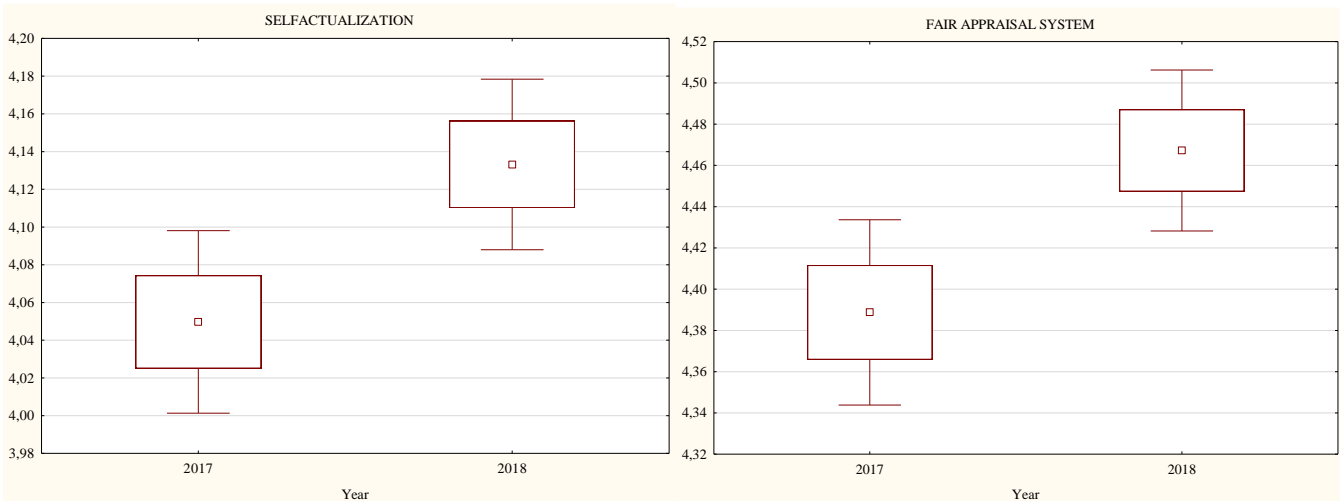


**Fig.3.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – name of the company

Source: Own research

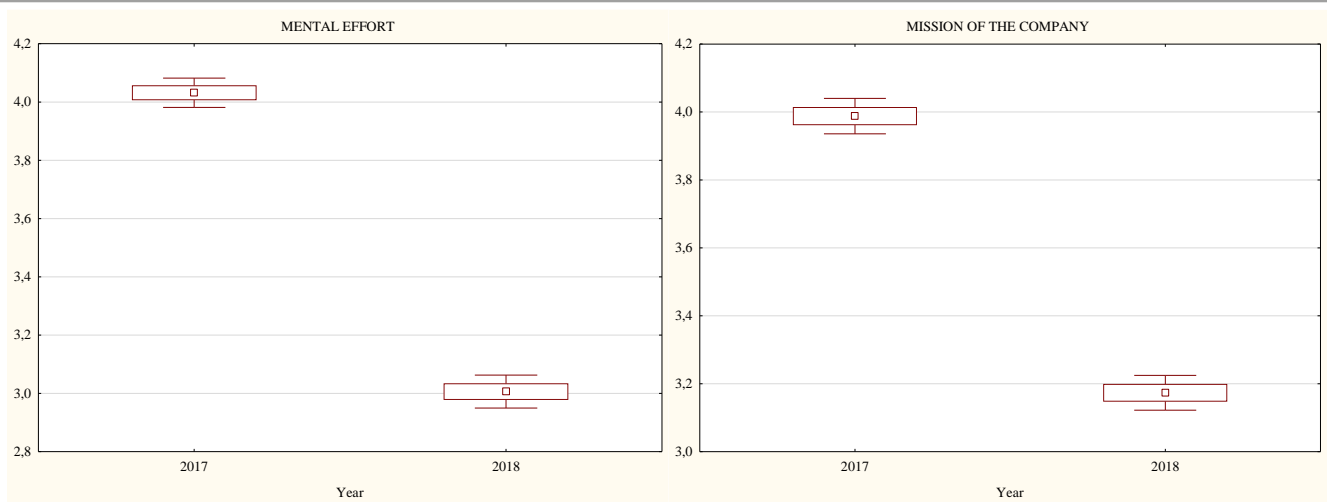
**Fig.4.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – prestige

Source: Own research



**Fig.5.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – selfactualization

**Fig.6.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – fair appraisal system

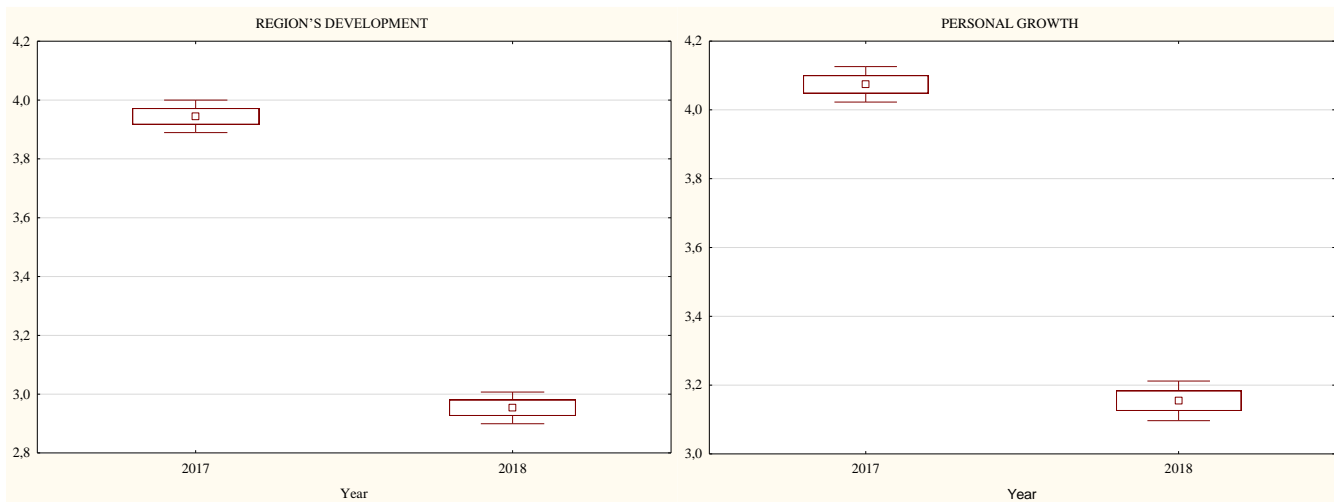


**Fig.7.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – mental effort

*Source:* Own research

**Fig.8.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – mission of the company

*Source:* Own research

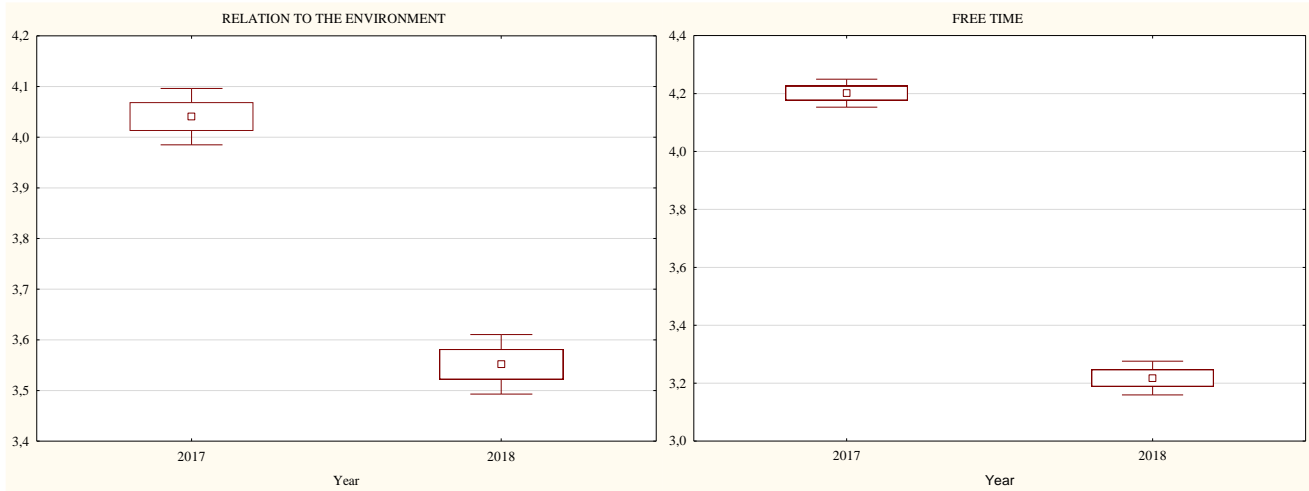


**Fig.9.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – region's development

*Source:* Own research

**Fig.10.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – personal growth

*Source:* Own research

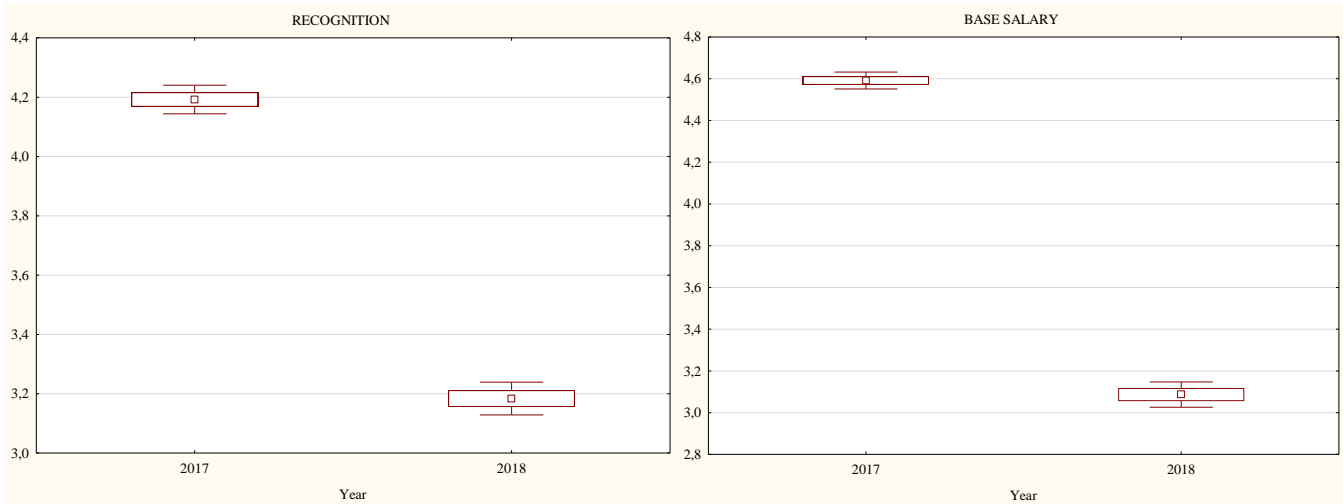


**Fig.11.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – relation to the environment

*Source:* Own research

**Fig.12.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – free time

*Source:* Own research



**Fig.13.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – recognition

*Source:* Own research

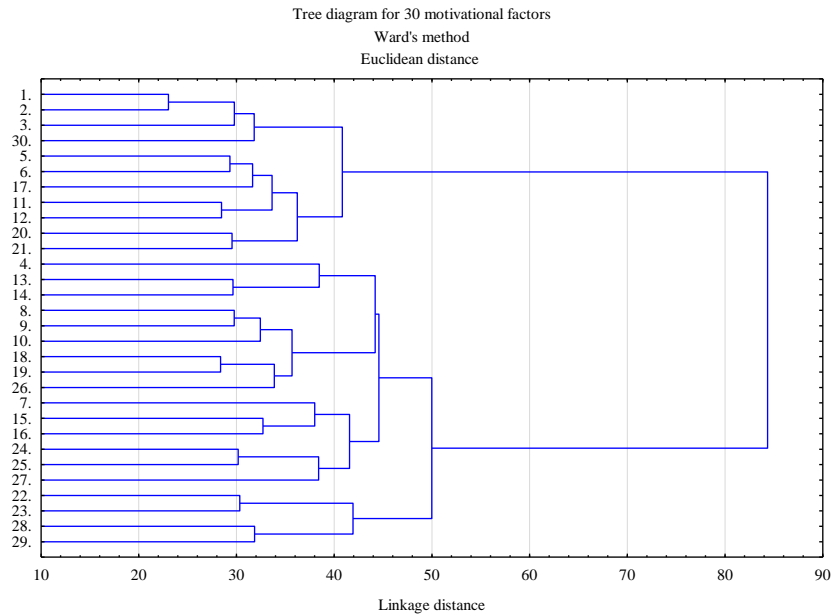
**Fig.14.** Motivational preferences of employees working in small enterprises in Slovakia in 2017 and 2018 – base salary

*Source:* Own research

Based on the research results, it can be said that motivational preferences of employees working in small enterprises in Slovakia change over time (within 1 year). This holds particularly true in the motivational preferences related to the social needs (mission of the company, name of the company, region's development, relation to the environment, free time). Considering the financial motivational preferences, the different factors are base salary and the fair appraisal system. In the motivational preferences related to the work there is a difference in the motivational factor mental effort. Based on the results, it can be said that our working hypothesis (WH<sub>1</sub>) has not been confirmed, so that motivational preferences of employees working in small enterprises in Slovakia are changing over time. Our findings are consistent with the results of Armstrong (2007) research, which

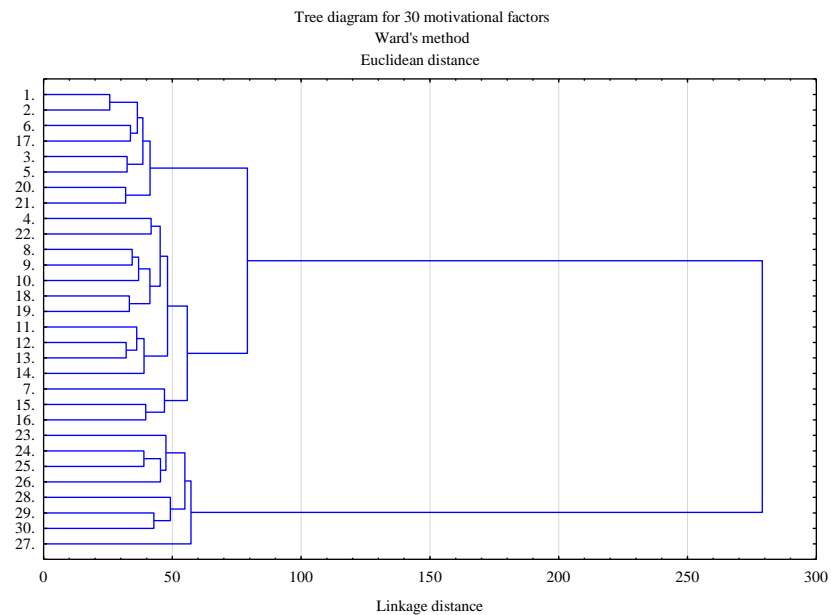


also stated that the set of motivational factors changes in time. The author cited identified several factors influencing the motivational preferences. It is knowledge, age, education, experience, surroundings, and so on.



**Fig.15.** Cluster analysis for motivational preferences of employees working in small enterprises in Slovakia in 2017

*Source:* Own research



**Fig.16.** Cluster analysis for motivational preferences of employees working in small enterprises in Slovakia in 2018

*Source:* Own research

**Table 5.** Distinguishing the groups of motivational factors preferred by employees working in small enterprises in Slovakia in 2017 and 2018

2017				2018			
	No.	Motivational factors	relating to		No.	Motivational factors	relating to
Group 1	1.	Atmosphere in the workplace	mutual relationship	Group 1	1.	Atmosphere in the workplace	mutual relationship
	2.	Good work team	mutual relationship		2.	Good work team	mutual relationship
	3.	Fringe benefits	finance		6.	Communication in the workplace	mutual relationship
	30.	Base salary	finance		17.	Supervisor's approach	mutual relationship
	5.	Job security	work condition		3.	Fringe benefits	finance
	6.	Communication in the workplace	mutual relationship		5.	Job security	work condition
	17.	Supervisor's approach	mutual relationship		20.	Social benefits	social needs
	11.	Working hours	work condition		21.	Fair appraisal system	finance
	12.	Work environment	work condition		4.	Physical effort at work	work condition
	20.	Social benefits	social needs		22.	Stress	work condition
	21.	Fair appraisal system	finance		8.	Opportunity to apply one's own ability	career aspiration
Group 2	4.	Physical effort at work	work condition	Group 2	9.	Workload and type of work	work condition
	13.	Job performance	work condition		10.	Information about performance result	work condition
	14.	Career advancement	career aspiration		18.	Individual decision-making	career aspiration
	8.	Opportunity to apply one's own ability	career aspiration		19.	Selfactualization	career aspiration
	9.	Workload and type of work	work condition		11.	Working hours	work condition
	10.	Information about performance result	work condition		12.	Work environment	work condition
	18.	Individual decision-making	career aspiration		13.	Job performance	work condition
	19.	Selfactualization	career aspiration		14.	Career advancement	career aspiration
Group 3	26.	Personal growth	career aspiration	Group 3	7.	Name of the company	social needs
	7.	Name of the company	social needs		15.	Competences	career aspiration
	15.	Competences	career aspiration		16.	Prestige	career aspiration
	16.	Prestige	career aspiration		23.	Mental effort	work condition
	24.	Mission of the company	social needs		24.	Mission of the company	social needs
	25.	Region's development	social needs		25.	Region's development	social needs
	27.	Relation to the environment	social needs		26.	Personal growth	career aspiration
	22.	Stress	work condition		28.	Free time	social needs
	23.	Mental effort	work condition		29.	Recognition	career aspiration
	28.	Free time	social needs		30.	Base salary	finance
	29.	Recognition	career aspiration		27.	Relation to the environment	social needs

Source: Own research

Subsequently, using cluster analysis, the similar groups of motivational preferences of employees working in small enterprises in Slovakia in individual years were identified. Results are presented in Figure 15 and Figure 16. Following the results presented in Figure 15, Figure 16 and Table 5, it can be stated that in the two years analysed, it was possible to distinguish three similar groups of motivational preferences. The first group include motivational factors related to the mutual relationship and finance. The second group include motivational factors related to the work condition and career aspiration. The last group include motivational factors with the prevalence to social needs. Based on the research results, working hypothesis (WH<sub>2</sub>) has been confirmed, so the groups of motivational factors preferred by employees working in small enterprises in Slovakia do not change over time.

Appropriately choosing motivational factors that lead employees to performance is the core role of managers because employee performance is reflected on the overall performance of an enterprise. Research by Hersey (2013) confirms the fact that if employees are motivated, they use their skills to 80 to 90%. In the study by Kozjek and Ovsenik (2017), the authors confirmed the importance of positive motivation of employees in the enterprise. Their research has shown that motivation by management is a very important factor and concludes that the manager can influence employee motivation up to 46.7%. Jeffrey and Shaffer (2007) dealt with the importance of motivational preferences. Research was conducted in India in 131 businesses in various areas of the private and public sectors. Businesses spent 1 billion USD to motivate employees, expecting job production to grow by 7%

per year. The study revealed that in enterprises where motivational programs were introduced, production and productivity increased by an average of 41-61%, with the exception of businesses experiencing a severe economic recession. The study confirmed the importance and effectiveness of motivation in the context of the growing performance of the company.

## Conclusions

In today's economic conditions, it is essential for management to devote their attention to investing in human resources to increase employee performance (Fumasoli 2014; Hollenbeck et al. 2015; Mura, 2017; Alola et al. 2018; Černevičiūtė et al. 2018; Moskalenko 2018). The management of the company is most involved in the management of work performance, then it is the middle management level, and, last but not least, the employees themselves follow. However, human resources are also indispensable in companies, and where management has understood their role, they are both the initiator and implementer of all performance enhancing tools that guarantee the competitiveness and economic success of the organization. Previous research (Demir et al. 2015; Mura et al. 2015; Ibidunni et al. 2016; Ližbetin et al. 2017; Sardak et al. 2017; Vydrová, 2018; Korauš et al. 2018; Sánchez-Sellero et al. 2018) have confirmed that overall enterprise performance is affected by employees and their motivation. Therefore, in this context, managers of Slovak small enterprises, when creating motivational programs, have to accept the fact that, due to the time, changes in motivation preferences of employees are taking place. If managers accept this change, they can encourage employees to perform better.

## References:

- Al-Belushi, F.; & Rahman Khan, F. 2017. Impact of monetary incentives on employee's motivation: Shinas college of technology, Oman - A case study, *International Journal of Management, Innovation & Entrepreneurial Research* 3(1): 1-11.
- Alola, U. V.; Avci, T.; & Oztüren, A. 2018. Organization sustainability through human resource capital: The impacts of supervisor incivility and self-efficacy, *Sustainability* 10(8): 2610. <https://doi.org/10.3390/su10082610>
- Altınay, L.; Madanoğlu, M.; De Vita, G.; Araslı, H.; & Ekinçi, Y. 2016. The interface between organizational learning capability, entrepreneurial orientation, and SME growth, *Journal of Small Business Management* 54(3): 871-891. <http://dx.doi.org/10.1111/jsbm.12219>
- Armstrong, M. 2007. *Řízení lidských zdrojů*. Praha: Published by Grada Publishing.
- Aydın, A.; & Tiryaki, S. 2018. Impact of performance appraisal on employee motivation and productivity in Turkish forest products industry: A structural equation modeling analysis, *Drvena Industrija* 69(2): 101-111. <http://dx.doi.org/10.5552/drind.2018.1710>
- Bělohávek, F. *Jak řídit a vést lidi*. Brno: Published by Computer Press.
- Bielikova, T.; Cut, S.; & Uradnicek, V. 2014. The influence of the definition of risky company on financial situation diagnostic models in Slovak dynamic economic environment. *The 7th International Scientific Conference on "Managing and Modelling of Financial Risks"*: September 8-9, Ostrava, Czech Republic. 38-45.
- Bogdanović, M.; Vetráková, M.; & Filip, S. 2018. Dark triad characteristics between economics & business students in Croatia & Slovakia: What can be expected from the future employees? *Entrepreneurship and Sustainability Issues* 5(4): 967-991. [https://doi.org/10.9770/jesi.2018.5.4\(19\)](https://doi.org/10.9770/jesi.2018.5.4(19))
- Borisov, A.; Narozhnaia, D.; Tarando, E.; Vorontsov, A.; Pruel, N.; & Nikiforova, O. 2018. Destructive motivation of personnel: A case study of Russian commercial companies, *Entrepreneurship and Sustainability Issues* 6(1): 253-267. [https://doi.org/10.9770/jesi.2018.6.1\(16\)](https://doi.org/10.9770/jesi.2018.6.1(16))
- Boye, E.; Mensah, K.; & Amponsah-Tawiah, K. 2016. Employee motivation and work performance: A comparative study of mining companies in Ghana, *Journal of Industrial Engineering and Management* 9(2): 255-309. <http://dx.doi.org/10.3926/jiem.1530>

- Campbell, S.; Reeves, D.; Kontopantelis, E.; Middleton, E.; Sibbald, B.; & Roland, M. 2007. Quality of primary care in England with the introduction of pay for performance, *New England Journal of Medicine* 357(2): 181-190. <http://dx.doi.org/10.1056/NEJMs065990>
- Carr, S. C.; Parker, J.; Arrowsmith, J.; Haar, J.; & Jones, H. 2017. Humanistic management and living wages: A case of compelling connections? *Humanistic Management Journal* 1(2): 215-236. <http://dx.doi.org/10.1007%2Fs41463-016-0018-y>
- Carreras, A. B. L.; Arroyo, J. C.; & Blanco, J. E. E. 2018. Influence of the strategic planning and the management skills as factors internal of business competitiveness of SME's, *Contaduria y Administracion, Accounting and Management* 63(3): 9-10. <http://dx.doi.org/10.22201/fca.24488410e.2018.1085>
- Cseh Papp, I., Varga, E., Schwarczová L., & Hajós, L. (2018). Public work in an international and Hungarian context. *Central European Journal of Labour Law and Personnel Management*, 1 (1), 6 – 15
- Černevičiūtė, J.; & Strazdas, R. 2018. Teamwork management in creative industries: factors influencing productivity, *Entrepreneurship and Sustainability Issues* 6(2): 503-516. [https://doi.org/10.9770/jesi.2018.6.2\(3\)](https://doi.org/10.9770/jesi.2018.6.2(3))
- Chang, P. Ch.; Wu, T.; Liu, & Ch. L. 2018. Do high-performance work systems really satisfy employees? Evidence from China, *Sustainability* 10(10), 3360. <https://doi.org/10.3390/su10103360>
- Christianson, J. B.; Leatherman, S.; & Sutherland, K. 2008. Lessons from evaluations of purchaser pay-for-performance programs a review of the evidence, *Medical Care Research and Review* 65(Suppl. 6): 5S-35S. <http://dx.doi.org/10.1177/1077558708324236>
- Damij, N.; Levnajić, Z.; Skrt, V. R.; & Suklan, J. 2015: What motivates us for work? Intricate web of factors beyond money and prestige, *PLoS ONE* 10. <http://dx.doi.org/10.1371/journal.pone.0132641>
- Demir, M.; Demir, S. S.; & Nield, K. 2015. The relationship between person-organization fit, organizational identification and work outcomes, *Journal of Business Economics and Management* 16(2): 369-386. <http://dx.doi.org/10.3846/16111699.2013.785975>
- Denhardt, R. B.; Denhardt, J. V., & Aristogueta, M. P. 2013. *Managing human behavior in public and nonprofit organizations*. California, USA: Published by SAGE Publications.
- Diaz-Fernandez, M.; Bornay-Barrachina, M.; & Lopez-Cabrales, A. 2015. Innovation and firm performance: The role of human resource management practices, *Evidence-based HRM* 3(1): 64-80. <http://dx.doi.org/10.1108/EBHRM-10-2012-0012>
- Dobre, O. I. 2013. Employee motivation and organizational performance, *Reaser* 5(1): 53.
- Eisenberger, R.; & Aselage, J. 2009. Incremental effects of reward on experienced performance pressure: Positive outcomes for intrinsic interest and creativity, *Journal of Organizational Behavior* 30(1): 95-117. <http://dx.doi.org/10.1002/job.543>
- Fakhrutdinova, E.; Kolesnikova, J.; Yurieva, O.; & Kamasheva, A. 2013. The commercialization of intangible assets in the information society, *World Applied Sciences Journal* 27: 82-86. <http://dx.doi.org/10.5829/idosi.wasj.2013.27.emf.17>
- Fumasoli, T. 2014. Strategic management of academic human resources: A comparative analysis of flagship universities in Norway, Finland, Switzerland, and Austria, *New Voices in Higher Education Research and Scholarship* 18-37. <http://dx.doi.org/10.4018/978-1-4666-7244-4.ch002>
- Georgiadis, A.; & Pitelis, C. N. 2012. Human resources and SME performance in services: empirical evidence from the UK, *International Journal of Human Resource Management* 23(4):808-825. <http://dx.doi.org/10.1080/09585192.2011.561236>
- Grossbart, S. R. 2006. What's the return? Assessing the effect of "pay-for-performance" initiatives on the quality of care delivery, *Medical Care Research and Review* 63(Suppl. 1): 29S-48S. <http://dx.doi.org/10.1177/1077558705283643>
- Haar, J.; Carr, S. C.; Arrowsmith, J.; Parker, J.; Hodgetts, D.; Alefaio-Tugia S. A. 2018. Escape from working poverty: Steps toward sustainable livelihood, *Sustainability* 10, 4144. <http://dx.doi.org/10.3390/su10114144>
- Havierníková, K.; Lemańska-Majdzik, A.; & Mura, L. 2017. Advantages and disadvantages of the participation of SMEs in tourism clusters, *Journal of Environmental Management and Tourism* 8(6): 1205-1215. [https://doi.org/10.14505/jemt.v8.6\(22\).07](https://doi.org/10.14505/jemt.v8.6(22).07)
- Hersey, P.; Blanchard, K.; & Johnson, D. 2013. *Management of organizational behavior*. Published by Pearson.
- Herzberg, F. I. 1987. One more time: How do you motivate employees? *Harvard Business Review* 65(5): 109-120.

- Hollenbeck, J. R.; & Jamieson, B. B. 2015. Human capital, social capital, and social network analysis: Implications for strategic human resource management, *Academy of Management Perspectives* 29(3): 370-385. <http://dx.doi.org/10.5465/amp.2014.0140>
- Ibidunni, S.; Osibanjo, O.; Adeniji, A.; Salau, O. P.; & Falola, H. 2016. Talent retention and organizational performance, *Periodica Polytechnica Social and Management Sciences* 24(1): 1-13. <http://dx.doi.org/10.3311/PPso.7958>
- Jeffrey, S.; & Shaffer, V. 2007. The motivational properties of tangible incentives. *Compensation & Benefits Review* 39(3): 44-50. <https://doi.org/10.1177/0886368707302528>
- Jonec, P.; Beynon, M. J.; Pickernell, D.; & Packham, G. 2013. Evaluating the impact of different training methods on SME business performance, *Environment and Planning C: Government and Policy* 31(1): 56-81. <http://dx.doi.org/10.1068/c12113b>
- Kamasheva, A. V.; Valeev E. R.; Yagudin, R. Kh.; & Maksimova, K. R. 2015. Usage of gamification theory for increase motivation of employees, *Mediterranean Journal of Social Sciences* 6: 77-80. <http://dx.doi.org/10.5901/mjss.2015.v6n1s3p77>
- Korauš, A.; Mazák, M.; & Dobrovič, J. 2018. Quantitative analysis of the competitiveness of Benelux countries, *Entrepreneurship and Sustainability Issues* 5(4): 1069-1083. [http://dx.doi.org/10.9770/jesi.2018.5.4\(26\)](http://dx.doi.org/10.9770/jesi.2018.5.4(26))
- Kovaľová, M.; Hvolková, L.; Klement, L.; & Klementová, V. 2018. Innovation strategies in the Slovak enterprises, *Acta Oeconomica Universitatis Selye* 7(1): 79-89.
- Kozjek, K.; & Ovsenik, M. 2017. Model of knowledge management factors and their impact on the organizations' success, *Organizacija* 50(2):112-131. <http://dx.doi.org/10.1515/orga-2017-0008>
- Kropivšek, J.; Jelačić, D.; & Grošelj, P. 2011. Motivating employees of Slovenian and Croatian wood-industry companies in times of economic downturn, *Drvena Industrija* 62(2): 97-103. <https://doi.org/10.5552/drind.2011.1040>
- Lesáková, L. 2012. The role of business incubators in supporting the SME start-up, *Acta Polytechnica Hungarica* 9(3): 85-95.
- Lesáková, L.; Gundová, P.; Král, P., & Ondrušová, A. 2017. Innovation leaders, modest innovators and non-innovative SMEs in Slovakia: Key factors and barriers of innovation activity, *Organizacija* 50(4): 325-338. <http://dx.doi.org/10.1515/orga-2017-0024>
- Ližbetin, J.; & Bartuška, L. 2017. The influence of human factor on congestion formation on urban roads, *Procedia Engineering* 187: 206-211. <http://dx.doi.org/10.1016/j.proeng.2017.04.366>
- Ližbetinová, L. 2017. Clusters of Czech consumers with focus on domestic brands. *The 29th International Business Information Management Association Conference „Education Excellence and Innovation Management through Vision 2020: From Regional Development Sustainability to Global Economic Growth“*: May 3-4, Vienna, Austria. 1703-1718.
- Ližbetinová, L.; & Farkasova, V. 2016. Librarians competencies in the global environment. *The 16th International Scientific Conference on „Globalization and its Socio-Economic Consequences“*: October 5-6, Rajecké Teplice, Slovakia. 1204-1211.
- Malá, D.; Sedliačiková, M.; Dušak, M.; Kaščáková, A.; Musová, Z.; & Klementová, J. 2017. Green logistics in the context of sustainable development in small and medium enterprises, *Drvena Industrija* 68(1), 69-79. <http://dx.doi.org/10.5552/drind.2017.1620>
- Marková, V.; Sedliačiková, M.; & Gurova, D. H. 2016. The model of financial budgeting and planning for micro and small enterprises. *The 16th International Scientific Conference on „Globalization and its Socio-Economic Consequences“*: October 5-6, Rajecké Teplice, Slovakia. 1305-1312.
- Mason, R. D.; & Lind, D. A. 1990. *Statistical techniques in business and economics*. Boston: Published by Irwin.
- Matraeva, L.; Belyak, A.; & Konov, A. 2018. Corporate culture key criteria and clustering, *Journal of Applied Economic Sciences* 13(1): 34-42.
- Mészáros, M. (2018). “Employing” of self-employed persons. *Central European Journal of Labour Law and Personnel Management*, 1 (1), 31 -150
- Minárová, M. 2015. Managers in SMEs and their emotional abilities, *Acta Oeconomica Universitatis Selye* 4(1): 83-92.
- Moskalenko, A. A. 2018. Methodological characteristics of the use of strategic analysis in HR-related decision-making, *Academy of Strategic Management Journal* 17(4): 1-7.

- Mura, L. 2017. Current situation in Family Businesses. *Managerial trends in the development of enterprises in globalization era*, pp. 178-185.
- Mura, L., & Kljucnikov, A. 2018. Small Businesses in Rural Tourism and Agrotourism: Study from Slovakia. *Economics & Sociology*, Vol. 11, No. 3, pp. 286-300. <http://dx.doi.org/10.14254/2071-789X.2018/11-3/17>
- Mura, L.; & Mazák, M. 2018. Innovative activities of family SMEs: Case study of the Slovak regions, *Online Journal Modelling the New Europe* 27: 132-147. <http://dx.doi.org/10.24193/OJMNE.2018.27.06>
- Musa, H.; Debnárová, L.; Musová, Z.; & Krištofik, P. 2017. Gender equality and corporate governance in Slovakia, *E a M: Ekonomie a Management* 20(1): 98-110. <http://dx.doi.org/10.15240/tul/001/2017-1-007>
- Myint, S. S.; Leamprecha, N.; Pooncharoen, N.; & Rurkwararuk, W. 2016. An analysis of employee satisfaction of private banks in Myanmar, *International Business Management* 10(2): 101-114. <http://dx.doi.org/10.3923/ibm.2016.101.114>
- Nabi, N.; Ahmed, A. A. T.; & Rahman, S. 2017. Empirical study on human resource management practices with special reference to job satisfaction and employee turnover at investment corporation of Bangladesh, *Human Resource Management Research* 7(1): 54-64. <http://dx.doi.org/10.5923/j.hrmr.20170701.07>
- Němec, M.; Krišťák, L.; Hockicko, P.; Danihelová, Z.; & Velmovská, K. 2017. Application of innovative P&E method at technical universities in Slovakia, *Eurasia Journal of Mathematics Science and Technology Education* 13: 2329-2349.
- Pingping, S. 2017. Research on the innovation of enterprise employee incentive way management based on big data background, *Agro Food Industry Hi-Tech* 28(1): 1434-1438.
- Poliačiková, E. 2015. Key account management as a innovation form of entry to customers in Slovakia, *Acta Oeconomica Universitatis Selye* 4(1): 135-145.
- Prange, C.; & Pinho, J. C. 2017. How personal and organizational drivers impact on SME international performance: The mediating role of organizational innovation, *International Business Review* 26(6): 1114-1123. <http://dx.doi.org/10.1016/j.ibusrev.2017.04.004>
- Salyova, S.; Taborecka-Petrovicova, J.; Nedelova, G.; & Dado, J. 2015. Effect of marketing orientation on business performance: A study from Slovak foodstuff industry, *Procedia Economics and Finance* 34: 622-629. [http://dx.doi.org/10.1016/S2212-5671\(15\)01677-9](http://dx.doi.org/10.1016/S2212-5671(15)01677-9)
- Sánchez-Sellero, M. C.; Sánchez-Sellero, P.; Cruz-González, M. M.; & Sánchez-Sellero, F. J. 2018. Determinants of job satisfaction in the Spanish wood and paper industries: A comparative study across Spain, *Drvna Industrija* 69(1): 71-80. <http://dx.doi.org/10.5552/drind.2018.1711>
- Sardak, S.; Bilskaya, O.; & Simakhova, A. 2017. Potential of economy socialisation in the context of globalisation, *Economic Annals-XXI* 164(3-4): 4-8. <http://dx.doi.org/10.21003/ea.V164-01>
- Schouten, M.J. 2019. Undoing gender inequalities: insights from the Portuguese perspective, *Insights into Regional Development* (2): 85-98. [https://doi.org/10.9770/ird.2019.1.2\(1\)](https://doi.org/10.9770/ird.2019.1.2(1))
- Scheer, L.; & Sedmák, R. 2014. *Biometria*. Zvolen: Published by Technická univerzita vo Zvolene.
- Sertic, M. B.; Barcic, A. P.; & Klaric, K. 2018. Economic determinants and analysis of the European Union wood industry SMEs employment, *BioResources* 13(1): 522-534. <https://doi.org/10.15376/biores.13.1.522-534>
- Slovak Business Agency. 2018. *Malé a stredné podnikanie v číslach v roku 2017*. Retrieved from <https://www.npc.sk/file?uuid=b40742be-ac93-4fd0-ae60-b52467626139>
- Straková, J.; Kucharčíková, A.; Pártlová, P.; & Váchal, J. 2016. Foreign direct investment and transport serviceability – a prerequisite for the development and stability of national and regional economies, *Nase More* 63(3): 204-210. <https://doi.org/10.17818/NM/2016/S124>
- Triola, M. F. 1989. *Elementary statistics*. Redwood City: Published by The Benjamin/Cummings publishing Company.
- Urbancová, H.; Stachová, K.; & Stacho, Z. 2017. Using of performance appraisal methods in Czech and Slovak organisations, *Quality Innovation Prosperity* 21(3): 62-77. <http://dx.doi.org/10.12776/QIP.V21I3.890>



Van Herck, P.; De Smedt, D.; Annemans, L.; Remmen, R.; Rosenthal, M. B.; & Sermeus, W. 2010. Systematic review: Effects, design choices, and context of pay-for-performance in health care, *BMC Health Services Research* 10(1): 247-260. <http://dx.doi.org/10.1186/1472-6963-10-247>

Vetráková, M.; Ďurian, J.; Seková, M.; & Kaščáková, A. 2016. Employee retention and development in pulp and paper companies, *BioResources* 11(4): 9231-9243. <https://doi.org/10.15376/biores.11.4.9231-9243>

Vydrová, J. 2018. Identification of key employee benefits relating to employee satisfaction in selected health organizations in the Czech Republic. *Acta Oeconomica Universitatis Selye* 7(2), 175 – 187

Wang, W. T. 2016. Examining the influence of the social cognitive factors and relative autonomous motivations on employees' knowledge sharing behaviors, *Decision Sciences* 47(3): 404-436.

Weihrich, H.; & Koontz, H. 1993. *Management*. Praha: Published by VICTORIA Publishing.

Xu, Y.; Wang, Y.; Tao, X.; & Ližbetinová, L. 2017. Evidence of Chinese income dynamics and its effects on income scaling law, *Physica A: Statistical Mechanics and its Applications* 487: 143-152. <http://dx.doi.org/10.1016/j.physa.2017.06.020>

Žuřová, J., Švec, M., & Madleňák, A. (2018). Personality aspects of the employee and their exploration from the GDPR perspective. *Central European Journal of Labour Law and Personnel Management*, 1(1); 51 -60

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## EMPLOYMENT CHALLENGES IN SAUDI ARABIA: AN ATTITUDINAL STUDY

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**Abstract.** The urge to grow and oil price volatility lead Saudi Arabia to structurally reform itself. Among many things, this transformation calls for diversification away from oil and indigenization of the workforce. Saudi Arabia is one of the countries with considerable number of expatriate workers. The new policy is to replace expatriates with locals in various fields. Alas, are the Saudi students (prospective employees) ready to replace the expatriates in all the sectors? In this paper, the researchers tried to explore through a questionnaire the attitude of the students in replacing the expatriates with the help of Theory of Planned Behavior. In the process the study identifies the obstacles to overcome in order to achieve localization. The findings offer some insights to the academicians need to do more to prepare students for the workplace by providing basic skills and career orientation needed to succeed in private sector jobs after they graduate.

**Keywords:** labor market; saudization; theory of planned behavior; structural equation modeling (SEM)

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### 1. Introduction

The job market of Saudi Arabia is changing rapidly. The onus is to create more jobs in the private sector. The number of the Saudi graduates entering the job market is increasing day by day in the Kingdom. The acceleration of replacing the white-collar expatriates is at full swing. But there is a big gap in the number of Saudi graduates entering the job market and the available jobs by removing expatriates in the private and public sectors (Nereim, Algethami & Shahine 2018). The fact that government's receding has been observed by studies (Sulphrey and AlAkahtani, 2016). In addition, the fear is that government may not manage for long because the wage bill exceeds more than 50% of total expenditure of Saudi Arabia and 16% above gross domestic product (Fasano and Goyal 2004). In this scenario, many questions arise here such as: What kind of jobs do Saudi students are interested in? Are they ready to take up private sector jobs?

As per SAMA (2018), in the year 2017, the Saudis constituted 95% while non-Saudis constituted only 5% of the total number of employees in the government sector (1233856). But the labour force in the private sector (10211201) constitute of 81.40% of non-Saudis and only 18.59% of Saudis. Even the National Transformation Program 2020 plans to generate over 450,000 jobs in the non-government sector by the year 2020. Moreover, the public sector is almost saturated in terms of providing employment opportunities (Ministry of Economy and Planning, 2005). Hence, this study proceeds with the objective of studying the perception of prospective employees towards the job nature. Moreover, Looney (2004) says, care must be taken in replacing the skilled expatriates for achieving the target of Saudization, otherwise there could be brain drain which affects sensitive economy. Sadi (2013) says, to offset the negative impact of Saudization, appropriate people must be hired for selective jobs. Hence, preparing students for jobs is important.

The study tries to find out Saudi students' attitude towards physical work, work on field or high mobility jobs. Their readiness towards rigid and long hours' work. Is culture playing any role in determining a job? When the need arises, are they ready to take up a job which has low prestige value in the society? Are they ready to take up any nature of job or still want to have administrative jobs which offer security wherein employer cannot fire on his will? Are they ready to be employed of not their choice or like to be unemployed until they get a job of their choice? It is important to understand the factors influencing the students' attitudes to take up the prospective careers in the Saudi context. Also, with the help of the principles of the Theory of Planned Behavior (TPB), the study tries to find the career intentions of participants.

## **2. Literature Review**

The nature of the job market is homogenous across GCC states. Shaban et al.1995 say, the citizens in GCC are ready to wait for the government job rather than to work in the private sector, though they have to wait for long. Al-Waqfi and Forstenlechner (2012) opine that the expectations of wages and working conditions are not matching with the market because they are used to high wages of public sector jobs that makes the private sector not interested in hiring them. And also, that public sector jobs are almost saturated. Mellahi (2006) says, there are cultural limitations in GCC countries that leads to increase in unsuitability of citizens for professional jobs. Jones (2008) argue that western management styles are interfere with local culture which influences perceptions of local graduates. Mellahi (2007) is of the opinion that the social status of an employee is determined by the type of work, sector, and social interactions in Gulf countries. As per Ali (2008) the citizens of GCC countries have the negative attitude on physical work, which is the biggest obstacle to the private sector employment.

The structure of the Saudi job market is such that it is dominated by expatriates. As per Harry (2007), there are 55% expatriate workers in Saudi Arabia. According to Fayad (et al. 2012), non-Saudi's constitute more than 60% of the workforce in Saudi, whereas Saudis are only 36% of the entire workforce. The Kingdom is actively pursuing Saudization. Al-Dosary and Rahman (2005) says, one of the problems Saudi has been facing for several years is job creation. As per Looney (2004), Kingdom has taken many initiatives to involve locals to boost their economy, as the present economy depends on expatriates. Al-Harbi (1997) says, Saudization means replacing the foreign workers with skilled Saudi labor force gradually.

Saudi nationals prefer government jobs (Al Asmari, 2008). Welfare is a social contract between government and employees and the government is the largest employer in Saudi (Mellahi 2007). Job security is major attraction towards the public sector (Al Sulimani 2006). The public sector provides middle to upper level management positions to many Saudis as soon as they graduate from the college (Baki 2004). Alas, government job market is almost saturated (Al Sheikh, 2015). Private employers are also facing issues in implementing Saudization such as locals do not work for the same salary as an expatriate does, job security and locals are against to the long working hours in the private sector (Al-Shammari 2009). Mellahi (2007) points out that, many young people do

not accept private jobs rather they are ready to wait for indefinite time for a government job and issue of 'wasta' is more severe in Gulf states. Saudis have slight or no incentive to look for employment besides the government sector as employment conditions are not favourable (Grant, Golawala, and McKechnie 2007).

Career choice has been studied earlier by many a study. Different dimensions such as; culture, psychological, economic and social dimensions determine the contextual career choices. Researches of Amani & Mkumbo 2014) have proved that career choices have been influenced by different factors in various fields. Conner & Armitage (1998) say, intention and behavior can be influenced by the external variables like culture, personality, or demographics. Intention and behavior may be influenced indirectly by external variables, as perceived behavioral control (PBC), subjective norm, and attitude mediate (Conner & Armitage 1998). Relative weights may be influenced by the external variables as determinants of their intentions, individuals place normative and attitudinal components (Fishbein, 1980). Ajzen (1991) says, in the prediction of intention, the relative importance of PBC, subjective norm, and attitude vary across situations and behaviors, who prefer government jobs, private jobs or not yet decided.

In Saudi Arabia there are certain phenomenon like: high wage expectations of the locals, negative attitude towards manual work, employers' control expatriate workers and difficulty in social integration in the multicultural setup (Mellahi 2007). It is easy to fire an expatriate employee which is not possible in the case of locals in private sector (Al Ali 2008). Traditions, attitudes, beliefs, behaviour, and values constitute the concept of national culture (1) Saudis do not show any interest to take up low-skilled jobs because of culture. (2) Saudis have high regards for diploma and university qualification, and vocational training and manual jobs are inferior in their view. (3) Social mobility is restricted by the traditional and social ties (Torofdar n.d.).

The education system also plays an important role in preparing the students for the jobs. Education system does not produce productive workforce rather it focuses on national identity in the GCC. Most of the academicians are from Syria, Jordan, Palestine, and Egypt. Because of the pan Arabism it resulted in low quality of education and 'Egyptianization' of school systems (Kapiszewski, 2004). Modifications in the examination pattern in Saudi Arabia has been recommended in studies (Sulphrey et al., 2018). Proper education system and suitable work ethics for the locals create productive jobs, employers should also support and transfer skills to the new graduates (Harry and Collings 2006). Al-Dosary and Rahman (2005) say, like Asian tiger economies, oil lead Saudi economy and its education system has not produced needed skills and attitudes for productive work ethics. The education system should be more practical oriented with additional 'time for learning at the working place' (Starineca & Voronchuk, 2015) enhancing 'learning beyond traditional education' (Tvaronaviciene, 2017).

### **3. Methodology**

This study plans to base its analysis on the Theory of Planned Behavior given by Ajzen (1991). According to the TPB three attributes influence human behavior: behavioral beliefs, normative beliefs, and control beliefs. Whereas behavioral beliefs guide favourable or unfavorable attitudes towards the behavior; normative beliefs result in perceived social pressure or subjective norm; while control beliefs give rise to perceived behavioral control (Ajzen, 1991). Three core constructs of TPB (attitude, subjective norm and perceived behavioral control) have been hypothesized to predict intentions related to career behaviors in different contexts (VanHooft, Born, Taris & Van der Flier, 2006).

A carefully chosen set of 8 statements' questionnaire on students' attitude towards nature of jobs, prepared in line with the TPB, has been administered in different colleges. The respondents are from different specialization namely; Engineering, Medicine, Business Administration, Computer Science, Law, Science and Pharmacy in Prince Sattam Bin Abdulaziz University. Using back translation method, the questionnaire was translated into

Arabic and distributed to the students. The respondents are supposed to respond on a Likert scale of 1 to 5, where 1 means strongly agree, 2 means agree, 3 means neutral, 4 means disagree and 5 means strongly disagree. The statements are tested for being significantly different from being neutral (score of 3) using one sample t-test. The results are analyzed at 5% level of significance using p-value approach.

In this paper the researchers also use structural equation modeling. It is used to apply the concept of TPB in the context of this study. The researchers preferred this method because in a single analysis it estimates the multiple and interrelated dependence. For data analysis structural equation modeling (SEM) is broad and flexible technique. This method combines both multiple regression or path analysis and factor analysis which is mainly used to analyze structural relationships. A structure is implied between covariances and the observed variables in this equation model. It is always used to analyze the latent constructs. TPB and SEM has been used to study intentions of students in Saudi Arabian context (Naushad, 2018).

#### 4. Analysis

A total of 460 questionnaires were administered. Questionnaires with incomplete entries were neglected, making the final sample size 435. Out of 435 students across 7 colleges in the university, 171 students wanted to take up government jobs. Whereas only 90 students are ready to take up private sector jobs and 174 students are not yet decided the sector of the job they want to do.

**Table 1.** Descriptive of the statements

	Statements	Mean	Standard Deviation	t-statistic	Sig. (2-tailed)
S1	I can take a job which requires physical work/ work on field/high mobility	3.29	1.17	5.25	0.00
S2	I will take up a job which has reasonable working hours with better work culture	1.80	0.87	-28.69	0.00
S3	I will take up a job that my friends and family don't approve	4.01	1.10	19.12	0.00
S4	Even if need arises, I will not take up a job that has low prestige value in society	2.83	1.21	-2.89	0.00
S5	I will prefer a job of administrative nature wherein I would be the boss	2.52	1.07	-9.48	0.00
S6	I can take up a job which has low security and where the employer can fire at his will	2.76	1.03	-4.97	0.00
S7	I like to be unemployed until I get a job of my choice	1.72	0.92	-28.69	0.00
S8	I like to take a job which offers higher perks and pay, no matter whether it is government or private sector job	1.83	1.00	-24.85	0.00

**Table 2.** Preferences of respondents (in percentage)

Statements								
	S1	S2	S3	S4	S5	S6	S7	S8
Strongly Agree	7.6	43.4	4.1	11.3	19.1	16.1	51.3	47.4
Agree	16.8	38.6	5.5	35.9	31	15.9	32.2	32.2
<b>Strongly agree &amp; agree</b>	<b>24.4</b>	<b>82</b>	<b>9.6</b>	<b>47.2</b>	<b>50.1</b>	<b>32</b>	<b>83.5</b>	<b>79.6</b>
Neutral	32.9	14.3	18.4	24.8	33.6	48.3	11.5	14.3

Disagree	24.4	2.1	29.4	14.9	11.5	15.9	3.2	3
Strongly Disagree	18.4	1.6	42.5	13.1	4.8	3.9	1.8	3.2
<b>Strongly disagree &amp; disagree</b>	<b>42.8</b>	<b>3.7</b>	<b>71.9</b>	<b>28</b>	<b>16.3</b>	<b>19.8</b>	<b>5</b>	<b>6.2</b>

Table 1 shows the scores of the mean and standard deviation of the respondents for the eight statements used in the questionnaire. Whereas table 2 shows the Likert five-point scale preferences (ranging from strongly agree to strongly disagree) of the respondents in terms of percentage for the statements in the questionnaire. Around 24.4 percent of the sample respondents are willing to take a job which requires physical work/ work on field/high mobility. 82 percent of the sample respondents wish to take a job which has reasonable working hours with better work culture. Only 9.6 percent of the sample respondents are willing to take up a job that their friends and family don't approve. 47.2 percent of the sample respondents will not take up a job that has low prestige value in society. 50.1 percent of the sample respondents prefer a job of administrative nature wherein he would be the boss. 32 percent of the sample respondents are willing to take up a job which has low security and where the employer can fire at his will. A great majority of the sample respondents (83.5 percent) are willing to be unemployed until they get a job of choice. But a good percentage of sample respondents (79.6 percent) like to take a job which offers higher perks and pay, no matter whether it is government or private sector job.

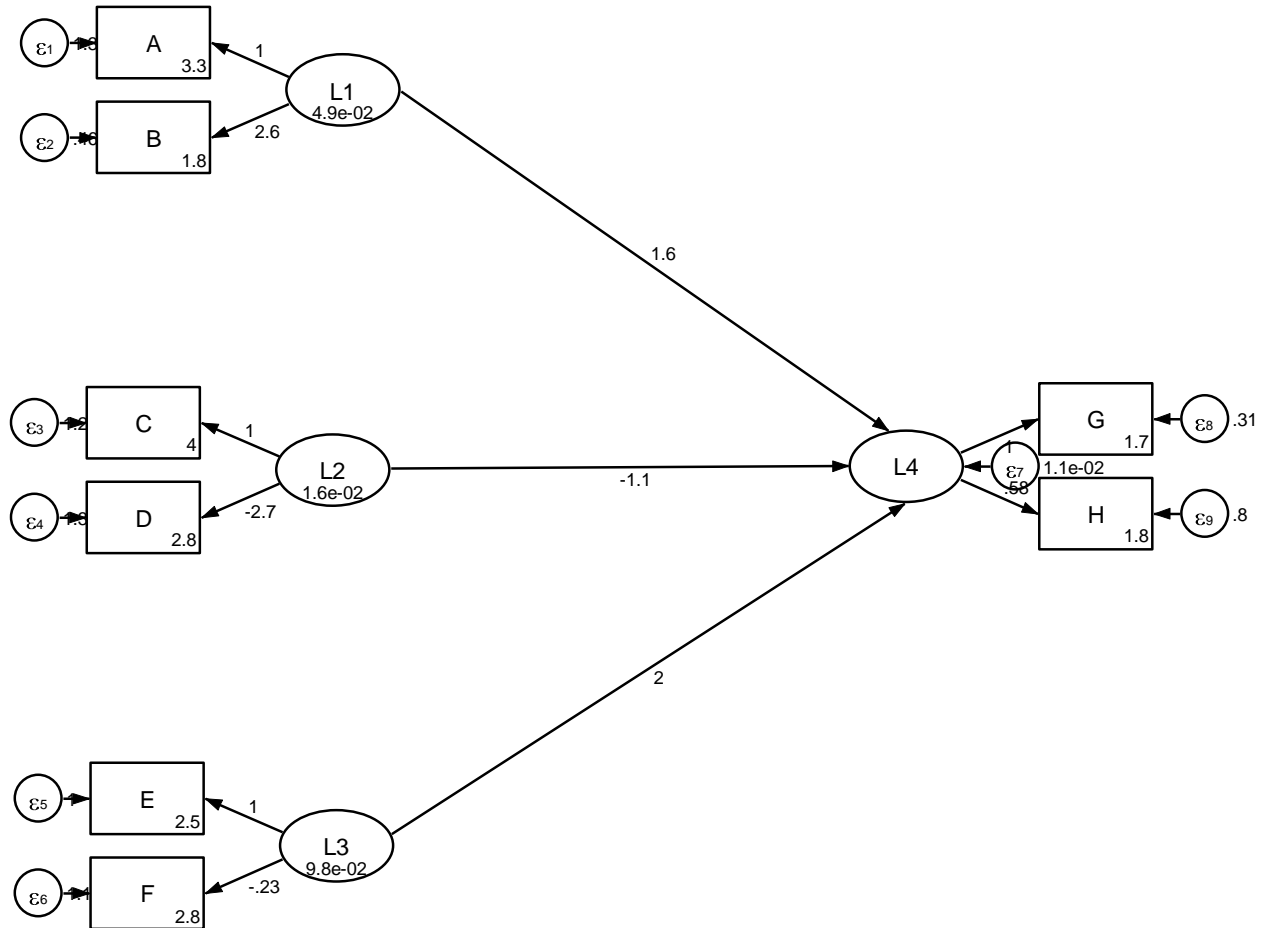
Next, another set of hypotheses are tested. It contains 8 hypotheses related to any significant difference between the respondents who preferred government job, private job or are still undecided in terms of the eight statements of the questionnaire. Only for two items there was a significant difference. They are:

**Hypothesis 1a:** There is a significant difference between respondents who prefer government jobs, private jobs and are still undecided in terms of 'I can take a job which requires physical work/ work on field/high mobility'. The hypothesis is significant as the p-value is 0.007. People who preferred government jobs had the highest mean score (4.21) followed by respondents who are still undecided (3.89) and respondents who preferred private sector jobs (3.83).

**Hypothesis 2a:** There is a significant difference between respondents who prefer government jobs, private jobs and are still undecided in terms of "I will prefer a job of administrative nature wherein I would be the boss". The hypothesis is significant as the p-value is 0.04. People who preferred government jobs had the highest mean score (2.34) followed by respondents who are still undecided (2.45) and respondents who preferred private sector jobs (2.67).

Next an attempt is made to formulate the path diagram using SEM. It is assumed that the statements related to attitude, subjective norm, and perceived behavioral control would impact the job intentions of the respondents. In the path diagram A, B, C, D, E, F, G, and H stands for the eight statements of the questionnaire namely, S1, S2, S3, S4, S5, S6, S7, and S8 respectively. L1, L2, and L3 denotes attitude, subjective norm, and perceived behavioral control respectively and L4 denotes job intentions. It is assumed that S1 and S2 indicates attitude; S3 and S4 indicate subjective norm; S5 and S6 indicate perceived behavioral control; and S7 and S8 indicate job intention. It is also assumed that attitude (L1), subjective norm (L2), and perceived behavioral control (L3) determines job intention (L4). The estimated path diagram is given below (Figure 1):

**Figure 1.** Path Diagram



SEM results indicate that for attitude the coefficient is 1.6, for subjective norm the coefficient is -1.1 and for perceived behavioral control the coefficient is 2. In other words, a 1 percent change in attitude in terms physical work/ work on field/high mobility working hours and work culture leads to 1.6 percent change in intent of doing a job. Similarly, a 1 percent change in subjective norm in terms of approval from friends and family, prestige value of job leads to a -1.1 percent change in intent of doing a job. Finally, a one percent change in perceived behavioral control in terms of administrative nature and job security leads to a 2 percent change in intent of doing a job.



## Conclusion

The study claims that around 40% of the respondents prefer to be employed in government jobs and only 20% prefer private jobs. The study acknowledges that government jobs market is already saturated. It also identifies the element in the economic transformation going on in the Kingdom, which calls for the need to generate more employment in the private sector. Using Azjen's Theory of Planned Behavior, this research attempts to study the attitude of sample respondents in Saudi Arabia towards job preference. This theory proposes that three attributes namely behavioral beliefs, normative beliefs, and control beliefs influence human behavior. This research studies the attitude of prospective employees (students) in terms of behavior, subjective norms, and perceived behavioral control towards their intention to join a job in future. Behavior in terms of physical work/ work on field/high mobility working hours and work culture is positively related with the intent of doing a job. But the contribution is less than the perceived behavioral control which consists of administrative job position and job security. And job intentions are negatively related with approval of friends and family, and prestige value.

Saudi students prefer jobs with reasonable working hours and good culture; jobs with prestige value and, jobs of administrative nature. Working hours and work culture of the private sector can be improved through interference of the government and labor laws. Prestige value of private sector jobs can be improved through increased awareness in the society at large, again with the efforts from government. Universities have a crucial role to play with reference to the preference for administrative nature jobs. These universities need to mentor the students and prepare them for challenging jobs.

The study identifies prospective elements related to attitude towards job. There is a difference between respondents who preferred government jobs and those who prefer private jobs. Respondents who preferred government jobs were least like to take a job that requires physical work/ work on field/high mobility. Also, respondents who preferred government jobs are more likely to prefer administrative job.

A good percentage of sample respondents like to take a job that offers higher perks and pay, no matter whether it is a government or private sector job. Hence, if the government wishes to improve the participation in the private sector, it needs to monitor the perks and pay in the private sector and makes it at par with the government sector. Also, as a great majority of the sample respondents are willing to be unemployed until they get a job of choice. Hence, proper mentoring of the university students is required to change their attitude towards private sector jobs.

The researchers would like to suggest that it is the high time that all the universities in the Kingdom should have career guidance or counselling cells. This liaison between university and incubators has been recommended by other studies also (Naushad et. al., 2018). These centers should conduct career awareness programs regarding opportunities and advantages in the private sector to the students twice every year. So, this study recommends the mentoring to help these students who are not yet decided about their career. These recommendations hold a fair chance, as around 40% of the students are still undecided about which type of job to join in future. These students can be mentored to provide their services in the private sector.

## References

- Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50(2): 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)

- Al Ali, J. 2008. Emiratisation: Drawing UAE Nationals Into Their Surging Economy, *International Journal of Sociology and Social Policy* 28 (9/10): 365–379. <https://doi.org/10.1108/01443330810900202>
- Al-Dosary, A.S.; Rahman, S.M. 2005. Saudization (Localization) – A Critical Review, *Human Resource Development International* 8(4): 495–502. <https://doi.org/10.1080/13678860500289534>
- Al-Asmari, M.G.H. 2008. Saudi Labor Force: Challenges and Ambitions, JKAU: Arts & Humanities, 16(2): 19-59. [https://www.kau.edu.sa/Files/320/Researches/51275\\_21466.pdf](https://www.kau.edu.sa/Files/320/Researches/51275_21466.pdf)
- Al-Harbi, K. 1997. Markov Analysis of Saudization in Engineering Companies, *Journal of Management in Engineering* 13(2): 87–91. [https://doi.org/10.1061/\(ASCE\)0742-597X\(1997\)13:2\(87\)](https://doi.org/10.1061/(ASCE)0742-597X(1997)13:2(87))
- Al-Shammari, S. A. 2009. Saudization and Skill Formation for Employment in the Private Sector. Retrieved from <http://hdl.handle.net/1893/679>
- Al sheikh, H.M. 2015. Current Progress in the Nationalisation Programmes in Saudi Arabia, Gulf Labour Markets and Migration, GLMM – EN, 2. [http://cadmus.eui.eu/bitstream/handle/1814/34580/GLMM\\_ExpNote\\_02\\_2015.pdf?sequence=1](http://cadmus.eui.eu/bitstream/handle/1814/34580/GLMM_ExpNote_02_2015.pdf?sequence=1)
- Al Sulimani, T. 2006. Transforming Saudi Organizations to Achieve Excellence through Human Resources: Are We Ready. Retrieved from <http://www.sma.org.sa/pdf/44/20.pdf>
- Amani, J.; Mkumbo, K.A.K. 2014. Influence of Family on Career Choice among Undergraduate Students, *Papers in Education and Development* 32(1): 167-180. Retrieved from [journals.udsm.ac.tz/index.php/ped/article/viewFile/1472/1378](http://journals.udsm.ac.tz/index.php/ped/article/viewFile/1472/1378)
- Al-Waqfi, M.A.; Forstenlechner, I. 2010. Stereotyping of Citizens in an Expatriate Dominated Labour Market: Implications for Workforce Nationalization Policy, *Employee Relations* 32(4): 364–381. <https://doi.org/10.1108/01425451011051596>
- Baki, R. 2004. Gender-Segregated Education in Saudi Arabia: Its Impact on Social Norms and the Saudi Labor Market, *Education Policy Analysis Archives* 12(28): 1–15. Retrieved from <http://ipac.kacst.edu.sa/eDoc/eBook/3804.pdf>
- Conner, M.; Armitage, C. J. 1998. Extending the theory of planned behavior: A review and avenues for further research, *Journal of Applied Social Psychology* 28(15): 1429-1464. <https://doi.org/10.1111/j.1559-1816.1998.tb01685.x>
- Fasano, U.; Goyal, R. 2004. Emerging Strains in the GCC Labor Markets, *International Monetary Fund Washington*, Working Paper WP/04/71 <https://www.imf.org/en/Publications/WP/Issues/2016/12/30/Emerging-Strains-in-GCC-Labor-Markets-17286>
- Fayad, G.; Raissi, M.; Rasmussen, T.; Westelius. N. 2012. Saudi Arabia: Selected Issues, *International Monetary Fund*. Retrieved from <http://www.imf.org/external/pubs/ft/scr/2012/cr12272.pdf>
- Fishbein, M. 1980. A theory of reasoned action: Some applications and implications, Howe, H. E.; & Page, M. M. (Ed.), *Nebraska Symposium on Motivation* Lincoln, NE: University of Nebraska Press 27: 65-116.
- Grant, J.; Golawala, F.S.; & McKechnie, D.S. 2007. The United Arab Emirates: The TwentyFirst Century Beckons, *Thunderbird International Business Review* 49(4): 507–533. <https://doi.org/10.1002/tie.20155>
- Harry, W.; & Collings, D. 2006. Localisation: Societies, Organisations and Employees’. Scullion, H.; & Collings, D. (ed) *Global Staffing*. London: Routledge, 139–156.
- Jones, S. 2008. Training and Cultural Context in the Arab Emirates: Fighting a Losing Battle? *Employee Relations* 30(1): 48–62. <https://doi.org/10.1108/01425450810835419>
- Kapiszewski, A. 2004. Arab Labour Migration to the GCC States. Arab Migration in a Globalized World. Geneva: International Organization for Migration 115–33. Retrieved from [http://publications.iom.int/system/files/pdf/arab\\_migration\\_globalized\\_world.pdf](http://publications.iom.int/system/files/pdf/arab_migration_globalized_world.pdf)
- Looney, R. 2004. Can Saudi Arabia Reform its Economy in Time to Head Off Disaster? *Strategic Insights* 3(1): 1-9. Retrieved from <http://www.hsdl.org/?view&did=444725>
- Mellahi, K. 2006. Human Resource Management in Saudi Arabia, Budhwar, P. & Mellahi, K. (ed.). *Managing Human Resources in the Middle East*, London: Routledge, 97–120.

Mellahi, K. 2007. The Effect of Regulations on HRM: Private Sector Firms in Saudi Arabia, *The International Journal of Human Resource Management* 18(1): 85–99. <https://doi.org/10.1080/09585190601068359>

Ministry of Economy and Planning. 2005. The Eighth Development Plan. Riyadh: Kingdom of Saudi Arabia.

Naushad, M. 2018. A study on the antecedents of entrepreneurial intentions among Saudi students, *Entrepreneurship and Sustainability Issues* 5(3): 600-617. [http://doi.org/10.9770/jesi.2018.5.3\(14\)](http://doi.org/10.9770/jesi.2018.5.3(14))

Naushad, M.; Faridi, M.R.; Malik, S. A.; 2018. Economic development of community by entrepreneurship: an investigation of the entrepreneurial intent and the institutional support to the local community in Al-Kharj region, *Entrepreneurship and Sustainability Issues* 5(4): 899-913. [http://doi.org/10.9770/jesi.2018.5.4\(14\)](http://doi.org/10.9770/jesi.2018.5.4(14))

Nereim, V.; Algethami, S.; & Shahine, A. 2018. Saudi Arabia reviews expat fees as economy feels sting, *Bloomberg* Retrieved from <https://www.bloomberg.com/news/articles/2018-12-09/saudi-arabia-said-to-review-expat-fees-as-economy-feels-sting>

Sadi, M. 2013. The Implementation Process of Nationalization of Workforce in Saudi Arabian Private Sector: A Review of ‘Nitaqat Scheme’, *American Journal of Business and Management* 2(1): 37–45. <http://doi.org/10.11634/216796061302294>

SAMA. 2018. Saudi Arabian Monetary Agency, Fifty Fourth Annual Report. <http://www.sama.gov.sa/en-US/EconomicReports/Pages/AnnualReport.aspx>

Shaban, R.A.; Assaad, R.; & Al Qudsi, S.S. 1995. The Challenge of Unemployment in the Arab Region, *International Labour Review* 134(1): 65–81. <https://heinonline.org/HOL/LandingPage?handle=hein.journals/intlr134&div=14&id=&page=>

Starineca, O.; & Voronchuk, I. 2015. Peculiarities of young specialists on labour market: case of Latvia, *The international journal entrepreneurship and sustainability issues* 2(4): 198-208. [http://doi.org/10.9770/jesi.2015.2.4\(3\)](http://doi.org/10.9770/jesi.2015.2.4(3))

Sulphey, M. M.; Alkahtani, N. S. 2017. Economic security and sustainability through social entrepreneurship: the current Saudi scenario, *Journal of Security and Sustainability Issues* 6(3): 479–490. [http://dx.doi.org/10.9770/jssi.2017.6.3\(12\)](http://dx.doi.org/10.9770/jssi.2017.6.3(12))

Sulphey, M. M.; Al Kahtani, N.S.; Abdul Malik Syed, A.M. 2018. Relationship between admission grades and academic achievement, *Entrepreneurship and Sustainability Issues* 5(3): 648-658. [http://doi.org/10.9770/jesi.2018.5.3\(17\)](http://doi.org/10.9770/jesi.2018.5.3(17))

Torofdar, Y. A. n.d. Human Resource Management (HRM) in Saudi Arabia: A Closer Look at Saudization. Retrieved from [http://zakiyas.weebly.com/uploads/6/5/6/7/6567507/closer\\_look\\_at\\_saudization.pdf](http://zakiyas.weebly.com/uploads/6/5/6/7/6567507/closer_look_at_saudization.pdf)

Tvaronavičienė, M., Shishkin, A., Lukáč, P., Illiashenko, N., & Zapototskyi, S. (2017). Sustainable economic growth and development of educational systems. *Journal of International Studies* 10(3); 285-292. <http://doi.org/10.14254/2071-8330.2017/10-3/21>

Van Hooft, E. J.; Born, M.; Taris, T.W.; & Van der Flier, H. 2006. The cross-cultural generalizability of the theory of planned behaviour: A study of job seeking in the Netherlands, *Journal of Cross-cultural Psychology* 37 (2): 1-10. <https://doi.org/10.1177/0022022105284491>

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## GREEN HUMAN RESOURCE MANAGEMENT- THE LATEST TREND OR STRATEGIC NECESSITY?\*

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**Abstract.** Our dynamically developing market economy has, for some time now, been a witness to a growing interest in the concept of business management involving conscious activities oriented not only at financial profits and economic aspects but also at broadly understood social and ecological interests. Such an approach, termed sustainable development, is becoming an imperative in the contemporary world, hence the decision processes of entrepreneurs tend to be more and more often guided by the principles of environmental corporate responsibility. The author of the study reckons that the implementation of the above business model requires, most of all, the engagement of the human factor. Eco-oriented management is performed exclusively by employees with positive attitudes towards the environment, green competencies, and responsible for the environmental consequences of their actions. Therefore, human resource management oriented at supporting the implementation of the principles of ecological development and the development of environmentally-friendly attitudes of employees referred to as Green Human Resource Management plays an unprecedented role in environmental performance. Green Human Resource Management is a novel approach to the performance of the HR function within organizations – one where environmental contexts constitute the foundation of all initiatives. This involves the application of HR policies in order to promote the sustainable use of company resources, to support ecology and development of ecological sensitivity in workers. This is because ecological awareness of employees and managers is key to the operations of any company complying with the concept of sustainability. The purpose of the study is to present the relevance of Green Human Resource Management to the operations of contemporary companies and indicate practices which can be undertaken in the field to promote knowledge related to the subject matter and extend the scope of concept application as a tool for constructing sustainable companies. The theoretical part of the study, drafted on the basis of a world's literature overview, identifies several environmental practices that can be employed in the field of human resource management at each stage of the personnel process, starting with work design, employee selection, work discipline shaping, to the development of “green” competencies and “green” working conditions. The empirical part of the research demonstrates the results of a questionnaire conducted at a random population of 300 Polish enterprises. The research approach used enabled the researcher to identify

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these initiatives in the field of Green HRM that, in the opinion of the study managers, play the key role in the process of shaping enterprise sustainable development.

**Keywords:** sustainability; environmental corporate social responsibility; green human resources management

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**JEL Classifications:** M12, M14, Q56, 015

**Additional disciplines:** ecology and environment

## 1. Introduction

Progressive degradation of the natural environment due to human exploitation brought about the need to introduce the concept of sustainable development. The sustainable development paradigm not only offers a new quality of management (Skowroński 2006) but also requires that novel sources of competitive advantage are sought to meet corporate economic goals and to heed broadly understood social and environmental interests (Hart, Milstein 2003; Abidin, Pasquire 2007; Joonhyun, Jinsoo 2018; Jabłoński 2018). Irrespective of the fact this concept has been explored for more than a dozen years now, whether at the macroeconomic or microeconomic level, it was not until recently that the relations between sustainable development and human resources in organizations were noted. However, it is the human factor which stimulates practices oriented at the improvement of organizations' environmental effectiveness. Eco-oriented management is performed exclusively by humans expressing a positive attitude towards the environment, competent in ecology, and bearing a sense of responsibility for environmental implications of their actions (Bombiak, Marciniuk-Kluska 2018; Smaliukienė, Monn 2019). Needless to say, Green Human Resource Management (GHRM) plays a significant role in the development of environmentally-friendly practices within organizations.

Green Human Resource Management (GHRM) is an element of Sustainable Human Resource Management (Stankevičiūtė, Savanevičienė 2018; Beck-Krala, Klimkiewicz 2017) oriented at generating value for company stakeholders through a simultaneous consideration for efficiency, social and environmental aspects in HR processes. HR processes play a significant role not only in the practical application of sustainable development policies (Renwick et al. 2008; Ulrich, Brockbank, Johnson 2009) but also in the construction of a sustainable development culture (Liebowitz 2010; Harmon, Fairfield, Wirtenberg 2010). That is why, the method of human resource management is crucial to environmental goals' attainment.

Despite the gravity of the subject area, Green HRM is relatively unknown among managers, which indicates that it is in its early phase of development. Source literature provides for a relatively low number of studies on the practical implementation of the concept. The author intends to bridge the gap, at least to some extent.

The objective of the study is to present the nature of the concept and assess the impact pro-environmental human resource practices may have on the sustainable development of organizations. In the course of research, attempts were made to verify the hypothesis assuming that GHRM practices have an impact on the sustainable development of organizations, and as such they may provide strategic support to concept implementation. The study was conducted based on a source literature inquiry and a diagnostic survey method involving a questionnaire survey.



## 2. Environmental Responsibility as a Factor for Corporate Competitiveness: theoretical aspects

Competitiveness is a feature delineating the outstanding skills of a given enterprise to take up activities ensuring its stable and enduring development, and contributing to its market value (Walczak 2010). Within contemporary economies, it is viewed as synergy effects of numerous internal factors (such as human resources, time and cost of production, technology, price, distribution network), as well as external mechanisms and preconditions (e.g. consumer preferences) (Gorynia 2000; Krawczyk 2012). Nowadays, due to growing social awareness with respect to the importance of green competitiveness – perceived as an ability to compete and take advantage of environmental actions (Adamkiewicz-Drwiłło, Kruk, Skrzyszewska 2008).

The meaning of environmentally-friendly activities is a consequence of an increase in sustainable development concept popularity, more and more often treated as a new business opportunity and a tool for gaining a competitive edge (Holliday 2001). According to its principals, to achieve success, organizations should focus not only on economic but also on social and environmental factors (Daily, Bishop, Steiner 2007). The enterprise-society-environment symbiosis is crucial (Olejniczak 2013), hence entrepreneurs become increasingly guided by Environmental Corporate Social Responsibility (ECSR). Its essence is to increase the value of an enterprise through (Chodyński, Jabłoński, Jabłoński 2008):

- the development of an effective business model based on environmental criteria;
- the creation of environmental innovations related to enduring corporate development;
- the distribution of tangible and intangible assets in the context of adopted environmental criteria;
- environmental standard reporting.

The ECSR approach signifies, above all, a concept whereby companies integrate environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.

Studies indicate a positive impact of environmental practices on a reduction in operating costs and new opportunities for development, which translates into improved financial performance (Olkiewicz 2016; Beurden, Gössling 2008; Matejun 2009; Lin et al. 2010) and competitive advantages (Wagner 2007). Environmental corporate responsibility may contribute to the creation of new business undertakings and improve interactions with stakeholders. Yet another effect of ECSR is environmental innovation, which not only brings about novel products and processes, delivering added value to both companies and customers, but also raises effectiveness of natural resource use in the economy and reduces the negative impact human activities have on the environment (Seroka-Stolka 2012; Ottman 2011; OECD 2011; Kemp, Pearson 2008). What is more, environmental corporate involvement facilitates winning local community acceptance and investor interest, thereby increasing access to funding. Needless to say, investors are keen on cooperating with companies which may take pride not only in their financial performance but also in operational transparency, honest development of corporate image and positive relations with third parties (Słupik 2014; Mishra, Suar 2010; Lai et al. 2010). Finally, the importance of other, non-financial effects, such as security increase, better working conditions, raised employee motivation to engage in environmentally-friendly activities are also highlighted.

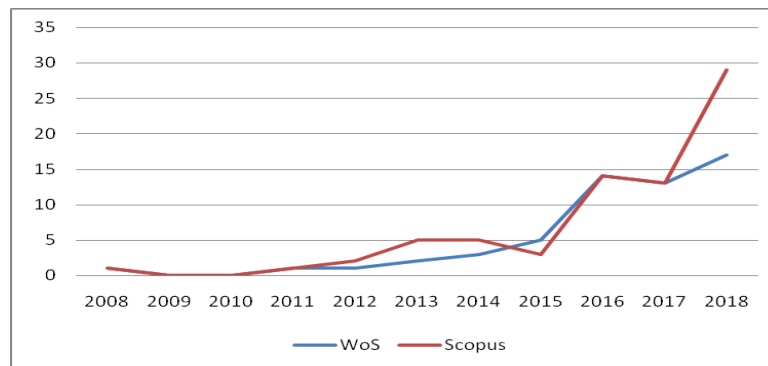
Given the foregoing, it can be stated that at present environmental corporate responsibility is not only beneficial but also, and above all, requisite. Nonetheless, the implementation of such a business model is mainly determined by the human factor. Sustainable company development based on green practices is only possible if the staff has relevant competencies relating to the implementation of its principles into practice, provided that such competencies are continuously developed and effectively applied. Therefore, the following thesis may be formed: the role of human resource management oriented at supporting the implementation of the principles of green development and shaping environmentally-friendly attitudes in employees, referred to as Green Human Resource Management, is irreplaceable.



### 3. The Essence of Green Human Resource Management: literature review

Human resource management is defined as a total of actions aiming at a provision of a required number of employees, demonstrating suitable skills and competencies, and creating conditions stimulating effective behavior of the staff, at a specific time and place (Pocztowski 1993). The core basis of the concept is formed by a subjective approach to human resources seen as a component of company assets and a source of corporate competitiveness.

Green Human Resource Management (GHRM) is an innovative approach to the performance of the HR function within an organization, in which the environmental context constitutes the basis of all undertaken initiatives (Pabian 2015). This means the application of HR policies to promote sustainable use of company resources and ecology (Mampra 2013; Zoogah 2011). GHRM is a key tool for the implementation of sustainable development (Urbaniak 2017; Gholam et al. 2016; Bangwal & Tiwari 2015; Renwick et al. 2013). A growing number of studies devoted to GHRM, as shown by the analysis of international databases (Figure 1), clearly reflects that many have become aware of that fact. However, we ought to bear in mind that the issue is relatively new, examined for less than twenty years, which indicates its early phase of development.



**Figure 1.** The number of publications containing the term “Green Human Resource Management” in selected databases  
Source: own research

Green initiative undertaken as part of GHRM are a part of wider corporate social responsibility programs (Mandip 2012). Its primary objective is to develop ecological sensitivity in employees and to make them aware of how their own behaviors may affect the environment. This is about motivation and making one feel proud of participation in green initiatives. This way, Green HRM supports the creation of a green workforce, who understands, appreciates, and practices ecological initiatives (Ahmad 2015; Opatha, Arulrajah 2014). The results of research suggest that green programs have a significant positive relationship to environmental performance (AnuSingh, Shikha 2015). Green Human Resource Management has been becoming a key business strategy for the significant organizations where human resource departments play an active part in going green at the organizations (Kar, Praharaj 2017). It has extended the boundaries of conventional HRM practices towards more sustainable and environmental strategies (Peerzadah, Mufti, Nazir 2018). Authors engaged in GHRM issues draw attention to a number of environmental practices applicable to the field of human resource management at each stage of the HR process. A selection of them is presented in Table 1.

**Table 1.** Examples of green practices at each stage of the HR function

HRM function	Green practice example
Green job design and analysis	<ul style="list-style-type: none"> <li>- inclusion of tasks related to environmental protection in job descriptions,</li> <li>- inclusion of green competencies as a part of a competency profile for each position,</li> <li>- creation of positions accountable for environmental corporate management.</li> </ul>
Employee selection (recruitment, selection, adaptation)	<ul style="list-style-type: none"> <li>- inclusion of environmental criteria in job announcements,</li> <li>- notifying candidates of employer's commitment to environment,</li> <li>- exposure of environmental values in job vacancy advertising,</li> <li>- asking questions related to ecology during candidate selection,</li> <li>- giving preference to candidates with competencies and experience in environmental projects,</li> <li>- introducing new employees to environmental standards of organization</li> </ul>
Developing working discipline	<ul style="list-style-type: none"> <li>- setting a set of transparent rules and regulation concerning green conduct principles,</li> <li>- developing a disciplinary system to discipline employees breaching the principles of green conduct,</li> <li>- pursuing disciplinary actions with respect to employees breaching the rules (warning, suspension, etc.)</li> </ul>
Green development	<ul style="list-style-type: none"> <li>- analysis and identification of employee needs with respect to environmental training,</li> <li>- provision of environmental training to develop green competencies,</li> <li>- encouraging employees to develop green competencies</li> </ul>
Green performance evaluation	<ul style="list-style-type: none"> <li>- conduct of environmental audits,</li> <li>- inclusion of environmental criteria in performance appraisals,</li> <li>- establishment of goals and responsibilities in relation to ecological initiative implementation</li> <li>- provision of regular feedback to employees on their progress in attaining ecological goals or improvement of their environmental effectiveness</li> </ul>
Green employee relations	<ul style="list-style-type: none"> <li>- providing opportunities to engage in green projects,</li> <li>- encouraging employees to submit ecological initiatives,</li> <li>- allowing employees to feel free when it comes to the formulation and experimenting with environmental projects,</li> <li>- provision of green projects advisory services and support,</li> <li>- joint consultations regarding the solving of corporate environmental issues,</li> <li>- sharing knowledge about environmental initiatives or programs</li> </ul>
Green working conditions	<ul style="list-style-type: none"> <li>- reducing paper use in offices,</li> <li>- energy-efficient bulbs,</li> <li>- turning off computers, television sets, and lights when the work is done,</li> <li>- giving preference to reusable energy sources (e.g. solar panels),</li> <li>- recycling programs,</li> <li>- initiatives aimed at occupational stress and occupational diseases reduction</li> </ul>

Source: compiled on the basis of: (Bangwal & Tiwari 2015; Arulrajah et al. 2015; Renwick et al. 2013; Opatha 2013; Ahmad 2015; Mathapati 2013; Opatha, Arulrajah 2014).

The analysis of environmental HR practices shown in Table 2 allows one to conclude that GHRM covers various initiatives which popularize environmental thinking amongst employees (Mishra, Sarkar, Kiranmai 2014) and encourage environmentally-friendly attitudes. It is underpinned in source literature that GHRM has long ago ceased to be a non-mandatory addition and instead became a necessity (Ackermann 2017; Müller-Camen, Zdravkovic 2012). Thus, it is vital to identify those GHRM practices, which support corporate sustainable development to the largest extent.

#### 4. Research methodology

The objective of the study is to assess the impact pro-environmental human resource practices may have on the sustainable development of organizations. The study was conducted based on a source literature inquiry and a diagnostic survey method involving a questionnaire survey. In the course of analyses, the following research problems were addressed:

- Are Polish managers familiar with the Green Human Resource Management concept?

- Which Green Human Resource Management practices are key to sustainable development of organizations in the Polish reality?

- Which Green Human Resource Management practices are most often used in Polish organizations?

In the course of research, attempts were made to verify the hypothesis assuming that GHRM practices have an impact on the sustainable development of organizations, and as such they may provide strategic support to concept implementation.

The subject matter of the research were environment-friendly human resource practices implemented across Polish enterprises. The diagnosis was conducted with reference to 7 areas of human resource policy:

- Green job design and analysis;
- Green recruitment;
- Shaping of green discipline at work;
- Green development;
- Green performance evaluation;
- Green motivation;
- Green HRM procedures.

The research attempted to evaluate the impact individual practices have on the sustainable development of the enterprises studied. The assessment of the impact was conducted with the application of a five-level Likert scale, where 1 signified a very low impact and 5 a very high impact of a given practice. To evaluate the scope of GHRM concept implementation in the Polish reality, the popularity of individual environmental human resource practices was analyzed.

The survey was conducted in 2018 on a random representative population of 300 medium and large enterprises with their seat in Poland. The study was conducted with the application of the CATI technique. The study sample was selected on a layer basis. First, 50 entities from each of the six Polish regions were drawn: Central, South, East, North-West, South-West and North. The survey targeted individuals in charge of human resource policy development in the enterprises studied. The characteristic features of the study population are shown in Table 2.

**Table 2.** Details of enterprises covered by the research

Criterion	Number of Enterprises	Percentage
Employment number:		
50-249 employees	125	41.7%
250-499 employees	94	31.3%
500-749 employees	33	11.0%
More than 500 employees	48	16.0%
Time on the market:		
up to 3 year	150	50.0%
3-5 years	14	4.7%
5-7 years	8	2.7%
7-9 years	2	0.6%
More than 9 years	126	42.0%
Type of ownership:		
limited liability company	179	59.7%
joint-stock company	52	17.3%
state-owned enterprise	69	23.0%
Scope of operations:		
international	130	43.3%
national	82	27.3%
regional	38	12.7%
local	50	16.7%
Main type of activity:		
services	162	54.0%
production	119	39.7%

trade	19	6.3%
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Source: own research

The most frequent type of ownership of young organizations was limited liability company (59.7%). The geographical coverage of the enterprises was highly-diversified, with the most numerous operating globally (43.3%). The prevailing type of business activity of the study entities was the provision of services (54%). The enterprises which prevailed in the population studied were medium-sized, i.e. employing between 50 and 249 employees (41.7%), operating on the market up to 3 years (50.0%). The analysis of research results in the group of young enterprises is presented in another paper (Bombiak, Marciniuk-Kluska 2018).

### 5. The Effect of GHRM on Corporate Sustainable Development in the Light of Empirical Research

The subject matter of the research were environmental practices implemented in the area of GHRM, further grouped into 7 areas of HR policy. The research attempted to evaluate the impact individual practices have on the sustainable development of the enterprises studied. The assessment of the impact was conducted with the application of a five-level Likert scale, where 1 signified a very low impact and 5 a very high impact of a given practice. The results of the analysis are presented in Tab. 3.

**Table 3.** The impact of GHRM practices on the sustainable development of organizations (scale of 1 to 5)

Area of GHRM	Activities	Mean impact assessment of an activity	Mean impact assessment of an area
Green job design and analysis	1. Inclusion of tasks related to environmental protection in job descriptions	2.9	2.7
	2. Inclusion of green competencies (such as ecological knowledge) as a part of competency requirements for each position	2.5	
	3. Creation of positions accountable for environmental corporate management	2.8	
Green recruitment	4. Communication of employer's commitment to ecology during recruitment	2.3	2.3
	5. Exposure of environmental values in job vacancy advertising	2.2	
	6. Verification of candidate's ecological knowledge and skills during recruitment process	2.2	
	7. Giving preference to candidates with competencies and experience in environmental projects	2.2	
	8. Introducing new employees to environmental standards of organization during adaptation	2.5	
The shaping of green discipline at work	9. Establishment of a clear set of rules and provisions regarding employee conduct in relation to environmental protection	2.7	2.5
	10. Development of a disciplinary system to discipline employees breaching the principles of ecological conduct	2.4	
	11. Implementation of disciplinary actions (such as warning, penalty, suspension, dismissal) against employees breaching the provisions and rules of environmental protection	2.4	
Green development	12. Analysis and identification of employee needs with regards to ecological training	2.4	2.4
	13. Provisions of ecological training for employees and managers to develop ecological skills and knowledge	2.4	
	14. Incentives for workers to develop green competencies	2.3	
Green performance evaluation	15. Inclusion of environmental criteria in performance appraisals	2.2	2.4
	16. Establishment of goals and responsibilities in relation to ecological initiative implementation	2.4	
	17. Conduct of environmental audits	2.6	
	18. Provision of regular feedback to employees on their progress in attaining ecological goals or improvement of their environmental effectiveness	2.4	
Green motivation	19. encouraging employees to submit ecological initiatives (e.g. ecological	2.4	

	project competitions)		<b>2.6</b>
	20. Provision of advisory services and support to solve ecological problems	2.3	
	21. Sharing knowledge about environmental initiatives or programs	2.4	
	22. Development of a rewards system for completion of ecological projects (awards, subsidies to wages)	2.3	
	23. Promoting environmentally-friendly attitudes when performing professional tasks (such as paper use reduction, waste sorting)	3.5	
Green HRM procedures	24. Inclusion of environmental goals of HRM in company strategy	2.6	<b>2.4</b>
	25. Measurement of effectiveness of environmental actions in HRM	2.4	
	26. Provision for HRM environmental actions-related expenditure in the budget	2.4	
	27. HRM environmental action progress monitoring	2.3	
	28. Drafting reports on environmental actions in HRM	2.3	
Average impact of GHRM practices on the sustainable development of organizations		<b>2.5</b>	

Source: own research

The analysis of data demonstrated in Table 3 allows one to confirm the indication that pro-environmental actions undertaken in the area of human resource management have an impact, with variations, on the sustainable development of the studied organizations. The impact assessment of individual activities ranged from 2.3 to 3.5. The activity with the greatest impact, in the opinion of the respondents, was activity no. 23, i.e. promoting environmentally-friendly attitudes when performing professional tasks (such as paper use reduction, waste sorting). The respondents assessed the impact of the activity at 3.5 on the 5-level scale. Other activities the respondents found crucial were:

- inclusion of tasks related to environmental protection (duties and responsibilities) in job descriptions (activity no. 1), with an impact average of 2.9;
- creation of positions responsible for environmental management aspects across organizations (activity no. 3), with an impact average of 2.8;
- establishment of a clear set of rules and provisions regarding employee conduct in relation to environmental protection (activity 9), with an impact average of 2.7;
- consideration Inclusion of environmental goals of HRM in company strategy (activity 24), and conducting environmental audits (activity 17), with an impact average of 2.6.

On the contrary, a very small impact on the sustainable development in organizations was associated by respondents with the following:

- exposure of environmental values in job vacancy advertising (activity 5);
- verification of candidate's ecological knowledge and skills during recruitment process (activity 6);
- giving preference to candidates with competencies and experience in environmental projects (activity 7);
- inclusion of environmental criteria in performance appraisals (activity 15).

The impact of the above activities was assessed at 2.2 on the 5-level scale used. Similar results were obtained by analyzing pro-ecological practices in the group of young enterprises (Bombiak, Marciniuk-Kluska 2018).

The analysis of the impact of individual GHRM areas demonstrates that the respondents perceive them as having a moderate impact on the sustainable development of organizations - the mean average regarded as the arithmetic mean of the assessment of individual areas was 2.5 points on the 5-level scale applied. The importance of individual areas varied in the opinion of the respondents. The area with the strongest impact was the work analysis and design stage, with the average impact calculated as the arithmetic mean of the assessment of individual practices divided by their number in a given area, was 2.7 points. In addition, a relatively high impact was ascribed to the area of encouraging employees to take up environmentally-friendly actions (2.6 points). These areas were regarded as principal from the point of view of the input of the HR function in the sustainable development of organizations. The effectiveness of Green motivation was also confirmed by the studies

conducted in Denmark, which showed that green motivation programs increased employee participation in pro-environmental initiatives (Forman, Joergensen 2001). In addition, research carried out in 376 Pakistani companies demonstrated the key role of educational practices for the purpose of attainment of environmental management goals (Bhutto, Auranzeb 2016). Needless to say, Green development practices appear underestimated in Poland, as they were listed fourth in terms of their impact on the sustainable development of organizations.

Relatively low ratings are also given to the importance of acquisition of job candidates with green competencies – the recruitment was ranked the lowest, with an impact average of merely 2.3 points. The insignificant impact of green acquisition of employees was also demonstrated by the studies conducted by Owino and Kwasira (Owino, Kwasira 2016) and Guerri et al. (Guerri et al. 2016). The latter of the studies referred to revealed that green recruitment was perceived as an activity having no impact on environmental performance of organizations.

Against this background, the scope of implementation of individual GHRM practices becomes a crucial research issue.

## **6. The Elements of GHRM in the Practice of the Study Enterprises**

To evaluate the scope of GHRM concept implementation in the Polish reality, the popularity of individual environmental human resource practices was analyzed. The study outcomes are illustrated in Chart 2. The most popular activity appeared to be promoting environmentally-friendly attitudes when performing professional tasks (such as paper use reduction, waste sorting). This practice was implemented relatively often - in as many as 78.7% of the study entities. Nearly a half of the analyzed enterprises (45.3%) included tasks related to environmental protection in job descriptions. In more than 1/3 of the studied entities:

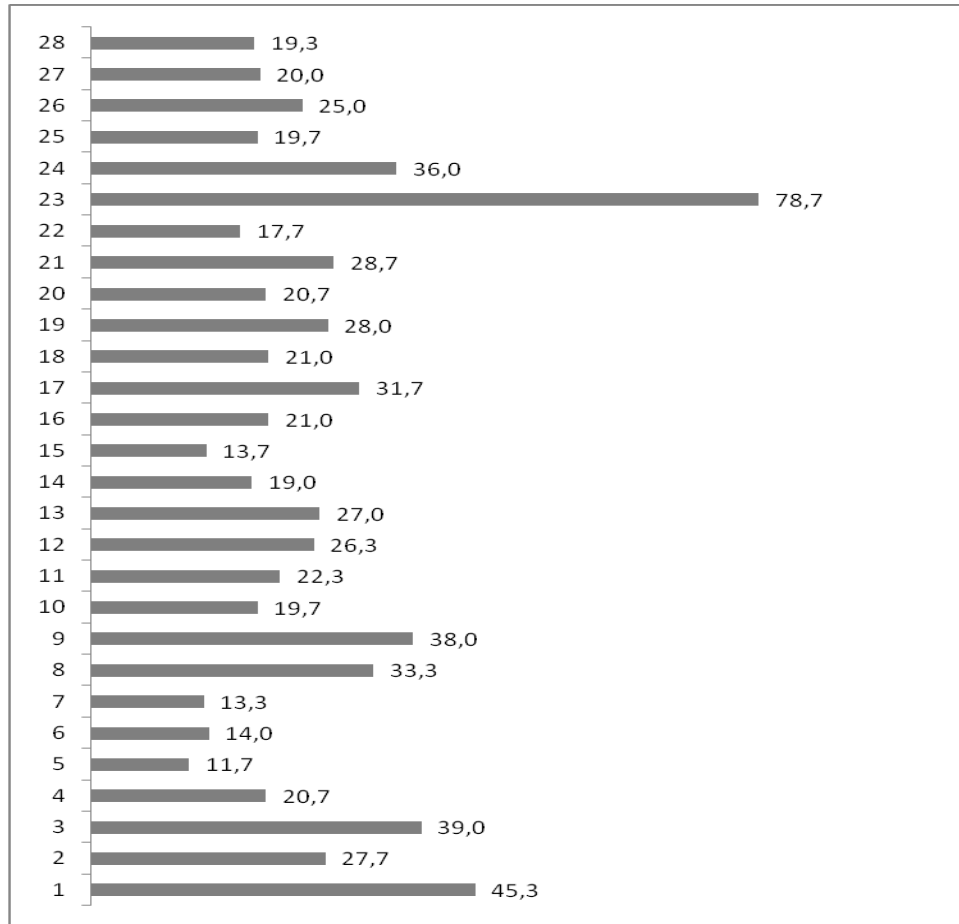
- a clear set of rules and provisions regarding employee conduct in relation to environmental protection was established;
- positions accountable for environmental corporate management were created;
- ecological HRM goals were accounted for in company strategy;
- new employees were introduced to environmental standards of organization during adaptation.

Contrary to the above, the rarest implemented practices covered:

- exposure of environmental values in job vacancy advertising, implemented in 11.7% of the studied entities;
- giving preference to candidates with competencies and experience in environmental projects, implemented in merely 13.3% of the studied enterprises;

inclusion of environmental criteria in performance appraisals, implemented in only 13.7% of the covered entities.

Similar results were obtained by analyzing pro-ecological practices in the group of young enterprises. In this case, also the most popular activity turned out to be activity promoting environment-friendly attitudes when performing professional tasks (such as paper use reduction, waste sorting). The remainder of practices were carried out by less than half of the study enterprises (Bombiak, Marciniuk-Kluska 2018).



Note: the y-axis shows the numbers of activities included in Table 3

**Figure 2.** The scope of implementation of GHRM practices in Polish enterprises (data shown in %)  
Source: own research

The results presented in Figure 2 demonstrate that the GHRM concept is rather unpopular in Polish organizations. Polish managers appear to be lagging far behind American companies in terms of GHRM concept application, as the latter have been commonly using environmental goal-based bonuses for the management (Wehrmeyer 1997). Studies conducted in Poland showed that ecological practices are implemented mainly to improve company image or to gain financial benefits (Beck-Krala, Klimkiewicz 2017). The development of environmentally-friendly attitudes of the staff is largely seen as a secondary advantage. However, the implementation of GHRM is indeed vital, for the pro-ecological attitudes developed in companies may actually be transferred to private lives (Whitmarsh, O'Neill 2010; Muster, Schrader 2011; Urbaniak 2017).

We can observe no systemic approach in the enterprises studies, the consequence of which is selecting a few, individual environmental practices in the GHRM area. The reason behind it could be, above all, limited knowledge in the field (Bombiak, Marciniuk-Kluska 2018). Such competency gap was confirmed by the analyses performed. Insight into Green HRM was confirmed by only one in four managers (26% of the respondents). In Poland, environmental corporate social responsibility (ECSR), a part of which is GHRM, remain a relatively unknown initiative in Poland. It is neither long-standing nor deep rooted in Polish enterprises. The main problem is the absence of perceiving environmental issues as elements of strategic management. Many entrepreneurs expect these to be handled by politicians and public officials. The main mechanism of environmental practices



implementation in the approach given becomes prescriptive legislation (Słupik 2014). GHRM practices, however, continue to be voluntary.

One of the difficulties related to GHRM implementation may also be a different perception of green economy (Urbaniak 2017). Whereas the management is inclined to create a more idealistic picture of a green company, the staff demonstrate a more cynical approach. These discrepancies may indicate a lack of green organizational culture (Harris, Crane 2002). It is underpinned in source literature that from the point of view of environmental performance of organizations GHRM practice formalization is required (Jabbour 2011).

## **7. Conclusions**

Environmental protection presents a considerable challenge for contemporary enterprises facing the need to find a balance between the economic expansion and environment-friendly actions. As demonstrated by the research, GHRM offers vital support to the green strategy implementation. GHRM is a new area of research within HRM oriented at the development of environmentally-friendly organizational culture and employee attitudes. Both the review of world's literature and the empirical studies confirm the thesis that pro-environmental actions undertaken in the area of GHRM have an impact on sustainable development.

In response to the question posed in the title to the study, it may be said that GHRM is not only a new trend but also a strategic necessity in the context of an increase in both social awareness concerning the environment and environmental protection requirements. The implementation of GHRM contributes to the development of the unique resource - the "green" human capital - which features an above-average environmental sensitivity and efficiency. Therefore, we may conclude that GHRM is the basis for the development of a continued competitive advantage for organizations.

Nevertheless, the concept appears undervalued and with a narrow scope of implementation in Polish companies. This proves that the HR function in Poland is still not considered a strategic partner, actively participating in the processes generating an added value for a variety of stakeholders. A development of GHRM qualifications is an essential condition to ensure an increased role of HRM in the shaping of sustainable organizations, for it is the absence of managers' knowledge in the field which is the main obstacle to the practical implementation of the concept. To overcome it, the nature of GHRM needs to be promoted in business circles, extensive research must be carried out on the impact of environmental human resource practices on sustainable development, and good practices in the area have to be displayed in social reports. A considerable challenge is further presented by the measurement of the impact of GHRM activities and their effect on financial performance of enterprises, as said activities should not exclude the principles of economic calculation. GHRM may yield an added value only when the pro-environmental goals of HRM are integrated into the general business policy of an enterprise.

This study contributes to source literature by diagnosing a gap associated with human resource policy use as a tool for supporting corporate sustainable development under Polish conditions, which constitutes the foundation for taking up corrective actions by managers. In the opinion of the author, the results of the cited studies may stimulate interest in the implementation of the GHRM concept in Polish organizations and the widening of the scope of its use as a tool for sustainable enterprise development.

## References:

- Abidin, N.Z.; Pasquire, Ch.L. 2007. Revolutionize value management: A mode towards sustainability, *International Journal of Project Management* 25: 275-282. <https://doi.org/10.1016/j.ijproman.2006.10.005>
- Ackermann, K.-F. 2017. Exploring Green Human Resource Management: Knowledge-based State of the Art, *Human Resource Management* 6(119): 21-10.
- Adamkiewicz-Drwiłło, H.G., Kruk, H., Skrzyszewska, K. 2008. Konkurencyjność przedsiębiorstw w świetle wymagań rozwoju trwałego i zrównoważonego [Enterprise competitiveness in the light of the requirements of sustainable and lasting development], *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* 20: 13-20.
- Ahmad, S. 2015. Green Human Resource Management: Policies and Practices, *Cogent Business & Management* 2(1): 1-13. <https://doi.org/10.1080/23311975.2015.1030817>
- AnuSingh, L.; Shikha, G. 2015. Impact of Green Human Resource Factors on Environmental Performance in Manufacturing Companies: An Empirical Evidence, *International Journal of Engineering and Management Sciences* 6 (1): 23-30. Retrieve from [http://scienceandnature.org/IJEMS-Vol6\(1\)-Jan2015/IJEMS%20Vol6\(1\)-6.pdf](http://scienceandnature.org/IJEMS-Vol6(1)-Jan2015/IJEMS%20Vol6(1)-6.pdf)
- Arulrajah, A.A.; Opatha H. H. D. N. P.; Nawaratne N. N. J. 2015. Green Human Resource Management Practices: A Review, *Sri Lankan Journal of Human Resource Management* 5: 1–16. <http://doi.org/10.4038/sljhrm.v5i1.5624>
- Bangwal, D.; Tiwari P. 2015. Green HRM – A way to greening the environment, *IOSR Journal of Business and Management* 17(12): 45-53. <https://doi.org/10.9790/487X-171214553>
- Beck-Krala, E.; Klimkiewicz, K. 2017. Reward Programs Supporting Environmental Organizational Policy, *Human Resource Management* 6(119): 41-56.
- Beurden, P.; Gössling, T. 2008. The worth of values – A literature review on the relation between corporate social and financial performance, *Journal of Business Ethics* 82(2): 407-424. <https://doi.org/10.1007/s10551-008-9894-x>
- Bhutto, S. A.; Auranzeb. 2016. Effects of Green Human Resources Management on Firm Performance: An Empirical Study on Pakistani Firms, *European Journal of Business and Management* 8(16): 119-125. Retrieve from <https://www.iiste.org/Journals/index.php/EJBM/article/viewFile/30983/31815>
- Bombiak, E.; Marciniuk- Kluska, A. 2018. Green Human Resource Management as a Tool for the Sustainable Development of Enterprises: Polish Young Company Experience, *Sustainability* 10(6): 1739. <https://doi.org/10.3390/su10061739>
- Chodyński, A.; Jabłoński, A.; Jabłoński, M. 2008. Environmental Corporate Social Responsibility (ECSR) – koncepcja strategiczna budowy wartości firmy oparta na kryteriach ekologicznych [Environmental Corporate Social Responsibility (ECSR) – a strategic concept based on environmental criteria], *Przegląd Organizacji* 3: 30-32.
- Daily, B. F.; Bishop, J.; Steiner, R. 2011. The mediating role of EMS teamwork as it pertains to HR factors and perceived environmental performance, *Journal of Applied Business Research* 23(1): 95–109. <https://doi.org/10.19030/jabr.v23i1.1411>
- Forman M.; & Joergensen, M.S. 2001. The Social Shaping of the Participation of Employees in Environmental Work within Enterprises – Experiences from the Danish Context, *Technology Analysis & Strategic Management* 13(1): 71-90. DOI: [10.1080/09537320120040455](https://doi.org/10.1080/09537320120040455)
- Gholami, G.; Rezaei G.; Saman M. Z. M. Sharif S.; Zakuan N. 2016. State-of-the-Art Green HRM System: Sustainability in the Sports Center in Malaysia Using a Multi-Methods Approach and Opportunities for Future Research, *Journal of Cleaner Production* 124: 142-163. <https://doi.org/10.1016/j.jclepro.2016.02.105>
- Gorynia, M. 2000. Luka konkurencyjna w przedsiębiorstwach a przystąpienie Polski do Unii Europejskiej [Competitiveness gap in enterprises vs Polish accession to the European Union], *Gospodarka Narodowa* 10: 48–67. Retrieve from [http://www.mariangorynia.pl/prasa/gn/Luka%20konkurencyjna%20w%20przedsi%C4%99biorstwach%20a%20przyst%C4%85pienie%20Polski%20do%20Unii%20Europejskiej.%20GN\\_2000\\_nr\\_10.pdf](http://www.mariangorynia.pl/prasa/gn/Luka%20konkurencyjna%20w%20przedsi%C4%99biorstwach%20a%20przyst%C4%85pienie%20Polski%20do%20Unii%20Europejskiej.%20GN_2000_nr_10.pdf)

- Guerci, M.; Longoni, A.; Luzzini, D. 2016. Translating Stakeholder Pressures into Environmental Performance: The Mediating Role of Green HRM Practices, *The International Journal of Human Resource Management* 27(2): 262–289. <https://doi.org/10.1080/09585192.2015.1065431>
- Harmon, J.; Fairfield, K. D.; Wirtenberg, J. 2010. Missing an opportunity: HR leadership and sustainability, *People & Strategy* 33(1), 16–21. Retrieve from <http://transitioningtogreen.com/wordpress/wp-content/uploads/2015/02/article-missing-opportunity.pdf>
- Hart S. L.; Milstein M. B. 2003. Creating sustainable value, *Academy of Management Executive* 17(2): 56–67. Retrieve from <https://www.kuleuven.be/emeritiforum/em/Forumgesprekken/F1617/230217/creating-sustainable-value-stuart-l-hart-and-mark.pdf>
- Harris, L. C.; Crane A. 2002. The Greening of Organizational Culture: Management Views on the Depth, Degree and Diffusion of Change, *Journal of Organizational Change Management* 15(3): 214–234. <https://doi.org/10.1108/09534810210429273>
- Holliday, C. 2001. Sustainable growth, the DuPont way, *Harvard Business Review* 79 (8): 129–132. Retrived from <https://hbr.org/2001/09/sustainable-growth-the-dupont-way>
- Jabbour, Ch. J. 2011. How Green Are HRM Practices, Organizational Culture, Learning and Teamwork? A Brazilian Study, *Industrial and Commercial Training* 43(2): 98–105. <https://doi.org/10.1108/00197851111108926>
- Jabłoński, M. 2018. Value Migration to the Sustainable Business Models of Digital Economy Companies on the Capital Market, *Sustainability* 10, 3113; <https://doi.org/10.3390/su10093113>
- Joonhyun, K. J.; Jinsoo, K. 2018. Corporate Sustainability Management and Its Market Benefits, *Sustainability* 10, 1455; <https://doi.org/10.3390/su10051455>
- Kar, A.K.; Praharaj, L. 2017. Green HRM: An Innovative Practice for Organisational Sustainability, *Indo-Iranian Journal of Scientific Research* 1(1):46–56. Retrived from <http://iijsr.com/data/uploads/1006.pdf>
- Kemp R.; Pearson, A. 2008. *Measuring Eco-Innovation*. Final report of MEI project for DG Research of the European Commission, Brussels. Retrived from <https://www.oecd.org/env/consumption-innovation/43960830.pdf>
- Krawczyk, M. 2012. Konkurencyjność przedsiębiorstw w świetle uwarunkowań ekologicznych [Company competitiveness in the light of environmental preconditions], *Studia i Prace WNEiZ* 25: 343–356. Retrived from [https://wneiz.pl/nauka\\_wneiz/sip/sip25-2012/SiP-25-343.pdf](https://wneiz.pl/nauka_wneiz/sip/sip25-2012/SiP-25-343.pdf)
- Liebowitz, J. 2010. The role of HR in achieving a sustainability culture, *Journal of Sustainable Development* 3(4): 50–57. <https://doi.org/10.5539/jsd.v3n4p50>
- Lin, Ch-P., Lyau, N-M., Tsai, Y-H., Chen, W-Y., Chiu, Ch-K. 2010. Modeling corporate citizenship and its relationship with organizational citizenship behaviors. *Journal of Business Ethics*, 95(3): 357–372. <https://doi.org/10.1007/s10551-010-0364-x>
- Mandip, G. 2012. Green HRM: People Management Commitment to Environmental Sustainability, *Research Journal of Recent Sciences*, 1: 244–252. Retrived from <http://www.isca.in/rjrs/archive/v1/iISC-2011/38.ISCA-ISC-2011-18CLM-Com-03.pdf>
- Mampra, M. 2013. Green HRM: Does it help to build a competitive service sector? A study. Proceedings of tenth AIMS International Conference on Management 2013, January 6–9: 1273–1281. Retrived from <https://pl.scribd.com/document/126544005/green-HRM-competitive-service-sector-pdf>
- Matejun, M. 2009. Zarządzanie innowacjami ekologicznymi we współczesnym przedsiębiorstwie [Ecological innovation management in contemporary enterprises], in Grądzki, R.; Matejun, M. (Eds.), *Rozwój zrównoważony – zarządzanie innowacjami ekologicznymi* [Sustainable development – managing ecological innovations]. Łódź: Wydawnictwo Media Press, 19–31.
- Mathapati, C. M. 2013. Green HRM: A strategic facet, *Tactful Management Research Journal* 2(2): 1–6.
- Mishra, R. K.; Sarkar, S.; Kiranmai J. 2014. Green HRM: Innovative Approach in Indian Public Enterprises, *World Review of Science, Technology and Sustainable Development* 11(1): 26–42. <https://doi.org/10.1504/WRSTSD.2014.062374>

Mishra, S.; Suar, D. 2010. Does corporate social responsibility influence firm performance of Indian companies? *Journal of Business Ethics* 95(4): 571–601. <https://doi.org/10.1007/s10551-010-0441-1>

Müller–Camen, M.; Zdravkovic, D. 2012. Green HRM: Schon Realität oder noch Zukunftsvision? [Green HRM: Already reality or still vision for the future?]. Retrieve from <http://www.hrm.de/fachartikel/green-hrm:-schon-realit%C3%A4t-oder-noch-zukunftsvision%3F>

Muster, V.; Schrader, U. 2011. Green work-life balance: A new perspective for Green HRM, *Zeitschrift Fur Personalforschung* 25(2): 140–156. Retrieve from <https://www.econstor.eu/bitstream/10419/71050/1/73759781X.pdf>

OECD. 2011. *Towards Green Growth*. Paris OECD. Retrieve from <https://www.oecd.org/greengrowth/48012345.pdf>

Olejniczak, K. 2013. Wpływ wybranych czynników ekologicznego aspektu CSR na przewagę konkurencyjną przedsiębiorstw działających na terenie województwa śląskiego [The impact of selected environmental factors of the CSR aspect on competitive advantage of companies operating across the Silesian Province], *Rocznik Ochrony Środowiska* 15(3): 2840–2849. Retrived from <https://docplayer.pl/5382023-Wplyw-wybranych-czynnikow-ekologicznego-aspektu-csr-na-przewage-konkurencyjna-przedsiębiorstw-działających-na-terenie-województwa-slaskiego.html>

Olkiewicz, M. 2016. Ekoinnowacje jako efekt foresightu strategicznego. [Eco-innovations as an effect of a strategic foresight] *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, 18(6): 152-156. Retrived from <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.agro-2c463d54-47dc-4a0e-b74d-dd8f3c96f72e>

Opatha, H. H. D. N. P.; Arulrajah, A. 2014. Green Human Resource Management: A Simplified General Reflections, *International Business Research* 7 (8): 101-112. <https://doi.org/10.5539/ibr.v7n8p101>

Opatha, H.H.D.N.P. 2013. Green Human Resource Management: A Simplified Introduction, *Proceedings of the HR Dialogue* 1(1): 11-21. Retrived from <http://dr.lib.sjp.ac.lk/bitstream/handle/123456789/3734/Green%20Human%20Resource%20Management%20A%20Simplified.pdf;jsessionid=ED070AAD2A41DA66829D94D09D6142BA?sequence=1>

Ottman, J. 2011. *The New Rules of Green Marketing: Strategies, Tools, and Inspiration for Sustainable Branding*. Brussels: Greenleaf Publishing.

Owino W.A., Kwasira, J. 2016. Influence of Selected Green Human Resource Management Practices on Environmental Sustainability at Menengai Oil Refinery Limited Nakuru, Kenya, *Journal of Human Resource Management* 4(3): 19-27. <https://doi.org/10.11648/j.jhrm.20160403.11>

Peerzadah, S.A; Mufti, S.; Nazir, N.A. 2018. Green Human Resource Management: A Review, *International Journal of Enhanced Research in Management & Computer Applications* 7(3): 790-795.

Pabian, A. 2015. Zrównoważone zarządzanie zasobami ludzkimi [Sustainable human resource management], *Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie* 17(7): 7-16. Retrived from <http://bazekon.icm.edu.pl/bazekon/element/bwmeta1.element.ekon-element-000171396555>.

Pocztowski, A. 1993. *Rozwój potencjału pracy jako problem zarządzania zasobami ludzkimi w przedsiębiorstwie* [Development of working potential as a problem in human resource management in a company]. Kraków: Akademia Ekonomiczna w Krakowie.

Renwick, D.; Redman, T.; Maguire, S. 2013. Green human resource management: a review and research agenda, *Intern. J. Manag. Rev.* 15 (1): 1–14.

Seroka-Stolka, O. 2012. Ekologiczna i społeczna odpowiedzialność biznesu w opinii przedsiębiorstw regionu częstochowskiego [Environmental and social corporate responsibility in the opinion of entrepreneurs of the Częstochowa region], *Journal of Ecology and Health* 16(3): 119-125. Retrived from <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-article-BAR8-0020-0046>.

Skowroński, A. 2006. Zrównoważony rozwój perspektywą dalszego postępu cywilizacji [Sustainable development as a perspective of further civilization progress], *Problemy ekorozwoju* 1(2): 47-57. Retrived from <http://ekorozwoj.pol.lublin.pl/no2/e.pdf>.

Słupik, S. 2014. Ekologiczna społeczna odpowiedzialność biznesu w strategiach rozwoju firm [Environmental corporate social responsibility in company development strategies], *Gospodarka w praktyce i teorii* 3(36): 74-87. Retrived from <http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.ekon-element-000171381247>

- Smaliukienė, R.; Monni, S. 2019. A step-by-step approach to social marketing in energy transition, *Insights into Regional Development* 1(1): 19-32. [https://doi.org/10.9770/ird.2019.1.1\(2\)](https://doi.org/10.9770/ird.2019.1.1(2))
- Stankevičiūtė, Ž.; Savanevičienė, A. 2018. Designing Sustainable HRM: The Core Characteristics of Emerging Field, *Sustainability* 10, 4798. <https://doi.org/10.3390/su10124798>
- Ulrich D.; Brockbank, W. 2005. *The HR Value Proposition*. Boston Massachusetts: Harvard Business School Press.
- Ulrich, D.; Brockbank, W.; Johnson, D. 2009. The role of strategy architect in the strategic HR organization, *People and Strategy* 32(1): 24–31. Retrived from <https://arwana007.files.wordpress.com/2012/02/the-role-of-strategy-architect-in-the-strategic-hr-organization.pdf>
- Urbaniak, B. 2017. Colorful Human Resource Management: What Are We Talking About? *Human Resource Management* 6(119): 9-19.
- Wagner, M. 2009. Innovation and competitive advantages from the integration of strategic aspects with social and environmental management in European firms, *Business Strategy and the Environment* 18(5): 291–306. <https://doi.org/10.1002/bse.585>.
- Walczak, A. 2010. *Analiza czynników wpływających na konkurencyjność przedsiębiorstw [The analysis of factors affecting company competitiveness]*, *E-mentor* 5(37). Retrieved from <http://www.e-mentor.edu.pl/artykul/index/numer/37/id/784>
- Wehrmeyer, W. 1997. Going Green Is Good for Business ... and for HR Staff, *Management Development Review* 10 (1): 30-31. <https://doi.org/10.1108/EUM0000000004350>
- Whitmarsh, L.; O'Neill, S. 2010. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviors, *Journal of Environmental Psychology* 30(3): 305–314. <https://doi.org/10.1016/j.jenvp.2010.01.003>
- Zoogah, D. 2011. The dynamics of Green HRM behaviors: A cognitive social information processing approach, *Zeitschrift fur Personalforschung* 25(2): 117–139. <https://doi.org/10.1177/239700221102500204>

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## STUDYING THE BANKING INDUSTRY'S STABILITY THROUGH MARKET CONCENTRATION INDICES\*

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**Abstract.** The optimal market structure is one of the fundamental issues of economic theory. At that, companies' efficiency in the market is associated with resource availability as a whole and finance resources, in particular. The structure of the banking market in terms of commercial loans determines a number of parameters of the economic system, such as its stability, growth potential, entrepreneurial activity, the state of commodity markets, the competitiveness of companies, etc. A comparative analysis of countries in terms of the ratio of commercial loans to GDP allows us to identify promising markets and strategic avenues for the development of the global banking industry and investment policy. However, a lack of regular and timely statistical reviews often impedes the identification. With the view to performing a comparative analysis for the EA/EU macroregion, the authors attempt to establish the types of the banking market in Russia based on a fuzzy rank approach using the probability theory. Using the data for 2009–2018, the authors assess bank concentration in Russia by a number of indicators. During the period under review, the volume of commercial banking lending in Russia experienced a steady increase. At the same time, there is a clear downward trend in the number of banks; several local “breakdowns” happen once every two years, i.e. the compression rate is reducing. Within the framework of the accepted gradation, the values of concentration indices taken separately do not allow arriving at a firm conclusion, since they indicate contradictory statuses of the sectoral market type. The integrated approach proposed in the paper helped find that, despite a relatively large number of participants in the Russian banking market, it should be primarily identified with a monopoly. At that, the values of the Herfindahl-Hirschman Index (HHI) and standard concentration fall within the oligopoly boundaries. This indicates the fuzzy nature of the sectoral market. The empirical results obtained are of use when analyzing competition, developing antimonopoly regulation measures, adjusting the banking sector development strategy and investment policy.

**Keywords:** sectoral concentration; competition; stability; banking industry; commercial lending; economic growth; Russia; EA/EU macroregion

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## 1. Introduction

Banking systems of many countries are currently being transformed. Despite individual differences, there is a clear trend towards a decrease in the number of banks and an increase in concentration of banking assets (Berger, 2003; Pawlowska, 2017; Basten and Sánchez, 2018; Pak and Iwata, 2018). Qualitative structural shifts in the financial sector can boost a long-term potential of economic growth and its sustainability. Empirical studies, with some exceptions, prove that. A more developed sector of financial intermediation is able to transform savings into investments more effectively, redistribute risks between economic agents and ensure a rapid exchange of economic data (Mamonov et al., 2017; Tvaronavičienė et al., 2018).

As with any industry market, the banking market needs to maintain competition and prevent monopolism. The condition is due to the necessity to improve the sustainability of the institutional system and protect market participants and stakeholders. In practice, the parameters of the normal level of competition for a particular banking sector are difficult to establish because of a number of factors, the primary of which is that the results of the assessment of the banking competition level can differ significantly depending on the approach applied. When examining market competitiveness, the analysis of the concentration level is of special importance. The concentration of market participants shows the relative size and the number of companies in the industry. Based on the data on the share of banks in different market segments, it is possible to evaluate the intensity and heterogeneity of competition.

In terms of volumes, one of the most powerful segments is the market for bank loans, i.e. loans to enterprises and organizations. The ratio of bank loans to GDP is a key factor in the economic development. At the same time, the heterogeneous distribution of commercial loans may affect the national economy sustainability and its exposure to business risks. A comparative analysis of countries by the indicator allows us to identify promising markets and strategic avenues for the banking industry development. However, a lack of regular and timely statistical reviews often impedes the identification. For example, empirical and poorly structured statistical data serve as the basis for analytical research of the banking market in Russia. This makes it difficult to compare Russia and other countries. In order to resolve this problem, we establish the types of the banking market in Russia based on a fuzzy rank approach using the probability theory.

It is worth noting that the increment rate of loans in Russia outruns the increment rate of GDP; however, Russia demonstrates one of the lowest rates of this indicator among large developed and developing countries. The ratio of bank loans to GDP in Russia falls within 60–70%. For comparison: the same ratio in Europe is over 150%; China – over 190%; the USA – over 230%; Brazil – over 100% and India – over 75% (Legacy Square Capital, 2017). Such a spread in figures indicates that, when it comes to financing production, the credit potential of Russian banks is underused. At the same time, long-term lending is hindered by the low capitalization of banks with a scarcity of internal reserves for its growth, the short-term nature of their resources, which cannot be transformed into investments due to the lack of an effective refinancing and funding system (Mukhametshina, 2014).

According to Mamonov et al. (2017), Russia is able to enhance domestic credit to private sector from 60% of GDP to the optimal 95–100% of GDP. Since Russia is rather far from the optimal level, the expansion will be safe in terms of risks to macroeconomic stability (of course, if it is not of an explosive character). The growing credit availability in the domestic market will smooth the dynamics of commodity output (reduce GDP volatility by 1.3 percentage points) and cause a somewhat increase in long-term GDP growth rates (by 0.3 percentage points). For this reason, the market for bank loans to non-financial organizations and the public in Russia is the subject of the most acute competition (Krylova, 2009a). As a result, there is obvious concentration in the Russian banking sector and the role of large banks is increasing. Risk-tolerance is a related issue here, since the elevated competitiveness of banks encourages opportunistic behavior (Marinč, 2013). We will look at these and other trends in details later in the present paper when evaluating concentration and establishing the type of an industry market for the Russian banking sector.

Theoretical and empirical studies demonstrate that the competitive structure of the banking market has both positive and negative effects. In the literature review, we summarized some of the identified patterns while arguing the importance of concentration and centralization of bank capital as a factor influencing the most important economic processes.

## 2. Literature review

Let us look at the views of economists on the nature of the processes of concentration and centralization of bank capital. According to Schlossberg (2004), concentration of bank capital is localization of the main mass of banking operations in a small number of large banks. Vishnever (2006) argues that the term “concentration” should be viewed as a process of enhancing a bank’s capital by capitalizing the share of value added. Centralization is an increase in capital preceded by consolidation of a number of smaller pieces into the large one (Krylova, 2009b).

There is a number of clear trends observed in the banking industry.

First, accumulation of bank capital is determined by the patterns of the expanded reproduction of all social capital under the specific historical conditions (Krylova, 2009a). The accumulation is ensured through a wide and more efficient use of the domestic funding sources (Medvedev, 2015).

Second, the problem of increasing concentration of bank assets is among the most urgent topics for scientific research conducted with a direct participation or assistance of central banks all over the world. The scrupulous attention of monetary authorities to this process is due to its possible positive and negative consequences for the monetary system and the entire national economy. The effects of increasing concentration in the banking industry (Berger, Demselz and Strahan, 1999), which sometimes have contradictory reasons, are the following: a drop in personal income and an adverse effect on the production volume (Jayaratne and Strahan, 1996; Shaffer, 1998; Collender and Shaffer, 2000); a fall in the business/entrepreneurial activity when it comes to starting new companies (Black and Strahan, 2000; Bonaccorsi and Dell’Ariccia, 2000; Kuzmin, 2018); a growing range and availability of banking services (Petersen and Rajan, 1995; DeYoung, Hunter and Udell, 2004); a rise in the financial leverage of companies, additional protection of creditors’ rights, but at the same time inadequate protection of property rights (González and González, 2008; Teresienè, 2018); increased consumer confidence (Idzik, 2017); the development of special forms of credit relations (Neuberger, Pedergrana and Rähke-Döppner, 2008); no strong need for measuring and regulating market power (Peláez and Peláez, 2009); strategic delay in entering the market (VanHoose, 2017); a destructive effect on credit availability for companies with financial constraints (Shikimi, 2013); etc.

Law and Singh (2014) point out that, if the state holds the largest portion of the bank capital, it increases interest rates, especially on mortgage, which lowers the standard of living of the population. Simoguk (2013) refutes this viewpoint by stating that monopolization in the banking sector guarantees interest rates to be stable and produces a positive trend in increasing interest rates on deposits, which leads to an increase in welfare.

Coricelli and Marc (2010), Cetorelli (2004) and Cetorelli and Strahan (2006) concentrate on examining the contradictions of theoretical modeling and empirical assessment of markets. They find that countries or regions with a more concentrated banking sector usually have more concentrated commodity markets. These findings emphasize the negative influence of banking concentration on economy and consequently on companies' performance and industrial development.

Hoxh (2013) looks at how the strengthening of banking competition and concentration affects the volatility of manufacturing sectors: banking concentration restrains the volatility of industries' growth, but as banking competition increases, so does the volatility of industries' growth. Pagano (1993) sticks to the same position and provides evidence of the adverse effect of the banking market's concentration on economic growth.

According to Svirydzenka and Yousef (2015), if banking concentration grows, it reduces economic sustainability, which, in turn, adversely affects not only the preservation of the growth potential, but also the ability to enter foreign markets (through the production of competitive goods/works/services). At the empirical level, industries that are more dependent on external financing grow faster than industry on average in countries with a high concentration in the banking market (Moiseev, 2008).

Mishkin (1992) comes up with similar ideas and associates banking concentration with the scale and scope of possible financial crises. Within the framework of the traditional theory of industrial organization, Moiseev (2008) suggests that large banks have a depressing effect on economy, and oligopoly (but not monopoly or perfect competition) is the structure of the banking market, which maximizes economic development.

Beck, Demircuc-Kunt and Levine (2006) hold opposite opinions. They suppose that current banking concentration leads to stability and consistency, which strengthens a country making it more attractive to foreign partners. At the same time, Hellman and DaRin (2002) propose a theory and empirical data demonstrating that more concentrated banking sectors encourage the development of new sectors and, thus, serve as catalysts for industrialization.

To explain these contradictions, it is noteworthy that the conditions for financial stability formed in developed countries are not always identical to those formed in transitional economies and can exert the opposite effect. In some cases, the consolidation of banks was a response to risk, uncertainty and increased competition; banking institutions, therefore, were forced to use the most cost-saving strategic tools to cut their costs and boost revenues (Ayadi, 2008).

Ely and Robinson (2005) believe that these processes are due to (1) the accelerated increase in the business scope and larger banks' capital mass driven by profit accumulation (direct concentration), and (2) acquisition of small banks by larger ones and creation of banking groups and concerns of banks (centralization). These processes are intertwined: mergers of banks usually stimulate an accelerated increase in their capital and income, and the rapid growth in the scale of economic operations allows restraining and dominating over competitors.

The literature review shows that over the last years competitiveness of national bank services markets has been analyzed using the Panzar-Rosse approach instead of concentration indicators (Bikker and Haaf, 2001; Coccorese, 2009; Anzoátegui, Martínez Pería and Melecky, 2010). Along with the method, the Bresnahan model (Rezitis, 2010) and the Barrush-Modeshtu model (Drobyshevsky and Paschenko, 2006) were also applied. The models for

measuring the degree of competition rely on the approaches of the new empirical theory of industry markets. They are based on the competition behavior of banks under the conditions where there are no ways to influence the outcome by utilizing the structural features of the market.

Quantitative concentration indicators, such as the concentration ratio, the Herfindahl-Hirschman index, the entropy index, the indices of Linda, Gini and Hall-Tideman, dispersion of market share distribution, the coefficient of variation, etc., are also traditionally used. According to Aliev (2017), the Herfindahl-Hirschman index (*HHI*) is the most optimal to evaluate concentration in the banking industry. The authors will try to neutralize the inconsistency of these methodological approaches through analyzing their assessment capabilities, limitations and applicability to the case under consideration.

### 3. Materials and Methods

As specified above, the structure of industry market is primarily characterized by its level of concentration. A number of studies (Shtapova, 2009; Ezrokh, 2013; Bikker, 2004; Edwards and Patrick, 2012; Blanco, 2011) support this view. At the same time, other distinguishing features of a market should be taken into account. The structure is also characterized by the three basic features: the number of suppliers (*N*), their market share (*S*) and concentration indices. It allows establishing the type of market under the conditionally permanent dynamics (Table 1). We propose considering several features underlying the conceptual understanding of the type of industry market.

**Table 1.** Distinguishing features of the main types of industry markets

Market type	Supply structure	Products/services	Barriers
Competition	A high number of suppliers with low quotas	Standardized	Low
Monopolistic competition	An average number of suppliers with medium quotas	Diversified	Low
Oligopoly	A low number of suppliers with high quotas	Standardized/diversified	Significant
Monopoly	Sole supplier	Exclusive	High

*Source:* (Avdasheva and Rozanova, 1998).

Kuzmin, Volkova and Fomina (2019) deal with the methods of the linear range approach.

The distribution of market shares is illustrated using the example of the cumulative Lorenz curve (Lorenz, 1905). The concentration ratio (*CR*) is calculated as the sum of the market share percentage held by the largest specified number of firms ( $n < N$ ) in an industry. The ratio indicates the proportions of the shares of the largest players and the shares of the smallest suppliers. This may cause inconsistencies when comparing different market spheres, which will not allow conducting research with the help of the method of known addition (Avdasheva and Rozanova, 1998). However, it is possible to calculate additional indicators applying the Herfindahl-Hirschman index, as well as the coefficients of market share dispersion, conditional concentration, etc.

Market share dispersion  $\sigma^2$  demonstrates a degree of discrepancy in the distribution of all market players' shares. The higher the dispersion value, the higher the market concentration. The major disadvantage of the approach is that it does not take into account the number of players (Avdasheva and Rozanova, 1998). In contrast, the Herfindahl-Hirschman index (*HHI*) is the optimal way to resolve the dispersion problem due to the quadratic formula (Hirschman, 1964):

$$HHI = \sum_{i=1}^N S_i^2 = N\sigma^2 + \frac{1}{N}. \quad (1)$$

If under perfect competition *HHI* is assumed to tend to zero, then if the index is 1, it is absolute monopoly. As a side note, the Federal Antimonopoly Service of the Russian Federation (FAS Russia order..., 2010) in its

calculations uses predominantly  $CR_3$  and  $HHI$ . The remaining indicators are supplementary. FAS Russia distinguishes between three levels of market concentration: high ( $CR_3 > 0,70$ ,  $HHI > 0,20$ ); moderate ( $CR_3 > 0,45$ ,  $HHI > 0,10$ ), and low ( $CR_3 < 0,45$ ,  $HHI < 0,10$ ).

The relative concentration ratio  $CRR_n$  is calculated as a ratio of the aggregated share  $n$  of the largest firms  $S_n^A$  to the share of their revenue  $Q_n^A$  (Besanko, 2009). The maximum share index  $I_{Smax}$  compares the market leader's share  $S_{max}$  with the average share  $S_a$ . Thus, under perfect competition, the index is 0, and under full monopoly, it is 1. Despite its simplicity, the index allows for both the measure of inequality and the number of players. However, there is a nuance here: the index does not take into account the ratio of outsiders (Cowell, 2011).

The *Gini* coefficient is related to the Lorenz curve and used to assess the inequality of the size of firms along with market share dispersion. The *Hall-Tideman/Rosenbluth index* is commonly used to calculate distribution of market players by shares. Under perfect competition, its value tends to 1 and falls (Hall and Tideman, 1967), if market concentration increases.

The *Linda's index* is aimed at comparing firms in the situation, where in the market there are more than one leader  $n > 1$ , and assessing their inequality. The index is a ratio between the market share of each supplier  $i$  with the market share of all market leaders from the 1st to the  $n$ -th (Linda, 1976):

$$L_{ind} = \frac{1}{n(n-1)} \sum_{i=1}^n \frac{S_i(n-i)}{(S_n^A - S_i)i}. \quad (2)$$

The value of the Linda's index is non-monotonic in relation to  $n$ . If the value of  $n$  increases from  $n=2$ , the value of  $L_{ind}$  decreases. The number of market leaders is the value of  $n$ , after which  $L_{ind}$  begins growing.

The *inverse share value index*  $I_{inv}$  (in percent) compares the sum of suppliers' inverse share values with the  $N^2/100$  index: if  $0.75 < I_{max} \leq 1$ , it is perfect competition; if  $0.5 < I_{max} \leq 0.75$ , it is monopolistic competition; if  $0.25 < I_{max} \leq 0.5$ , it is oligopoly (Cowell, 2011).

The perfect entropy ratio  $ER$  determines the average share of the firm and shows the entropy of shares distribution (Shannon, 1948). The higher  $ER$ , the lower market concentration and market power of each player. This ratio is used to compare the previous index between the markets. The closer  $ER$  to 0, the greater market concentration (Clarke, Davies and Waterson, 1984):

$$ER = \frac{\sum_{i=1}^N S_i \ln \left( \frac{1}{S_i} \right)}{\ln N}. \quad (3)$$

All these indices can be categorized into two groups: concentration indices ( $CR_n$ ,  $CRR$ ,  $HHI$ ,  $HT$ ) and share inequality indices ( $ER$ ,  $Gini$ ,  $L_{ind}$ ,  $I_{Smax}$ ,  $I_{inv}$ ,  $\sigma^2$ ). Each index has its own advantages and disadvantages by certain metrics (Table 2).

**Table 2.** Advantages and disadvantages of concentration indices

Parameter	Index/coefficient									
	CR <sub>n</sub>	CRR	HHI	HT	ER	Gini	L <sub>ind</sub>	I <sub>smax</sub>	I <sub>inv</sub>	σ <sup>2</sup>
Consistency (determines the development of outsiders)			+	+	+				+	+
Efficiency (determines the variability <i>S</i> )			+	+	+	+				+
Intuitivity (determines <i>N</i> and inequality)	+	+					+	+	+	
Behavior (determines the variability <i>N</i> and merger)					+		+			+

Source: generalized by the authors

Thus, there emerges the need for scaling the values of indices to level the disproportion of estimates. We have generalized the approaches to calculating coefficients and indices by producing a gradation of criteria indicating one of the three types of market: monopoly, oligopoly and monopolistic competition (Table 3).

**Table 3.** The matrix of criteria and boundaries of their values of indicators to determine the type of industry market

Index/coefficient	Aggregated type of market/criteria's boundaries					
	Monopoly		Oligopoly		Monopolistic competition	
	Lower	Upper	Lower	Upper	Lower	Upper
Concentration ratio <i>CR3</i>	70%	100%	45%	70%	0%	45%
Relative concentration ratio <i>CRR3</i>	0	0.5	0.5	1	1	+∞
The Herfindahl-Hirschman index <i>HHI</i>	1800	10000	1000	1800	0	1000
Dispersion of market share distribution	0.75	1.00	0.25	0.75	-∞	0.25
The Gini index	0.75	1.00	0.25	0.75	0.00	0.25
The Hall-Tideman index <i>HT</i>	0.75	1.00	0.25	0.75	-∞	0.25
Relative entropy <i>ER</i>	0.00	0.25	0.25	0.75	0.75	1.00
The maximum share index	0.75	+∞	0.50	0.75	-∞	0.50
The Linda's index	0	3	3	15	15	+∞
The inverse share value index	-∞	0.25	0.25	0.50	0.50	+∞

Source: generalized by the authors

In the present study, to resolve this task, the authors propose a method based on the probability theory. Using its provisions, the quantitative probability is established by the fact how close the current level of the indicator is to its boundary, which changes dynamically. Thus, even at the same or approximately the same values of the current level, probability may differ significantly depending on the dynamics of the boundary (threshold) level of the coefficient or index.

We believe that the search for the cumulative characteristic of the type of industry market should be carried out based on the Laplace distribution function (Kotz, Kozubowski, and Podgórski, 2001) and quadratic mean. The type of market will be determined as one of those presented, for which the calculated root mean square probability by the Laplace function is the highest. The mathematical representation of calculating probability by Laplace (Bening and Korolyov, 2008) takes into account such parameters as the lower and upper boundary of the acceptable range of fluctuations of the indicator values, the value of mean and standard deviation:

$$R(a < CP_i < BL_i) = 1 - \left[ L\left(\frac{BL_i - \bar{f}(CP_i)}{\delta(CP_i)}\right) - L\left(\frac{a - \bar{f}(CP_i)}{\delta(CP_i)}\right) \right], \quad (4)$$

$$L(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-\frac{t^2}{2}} dt,$$

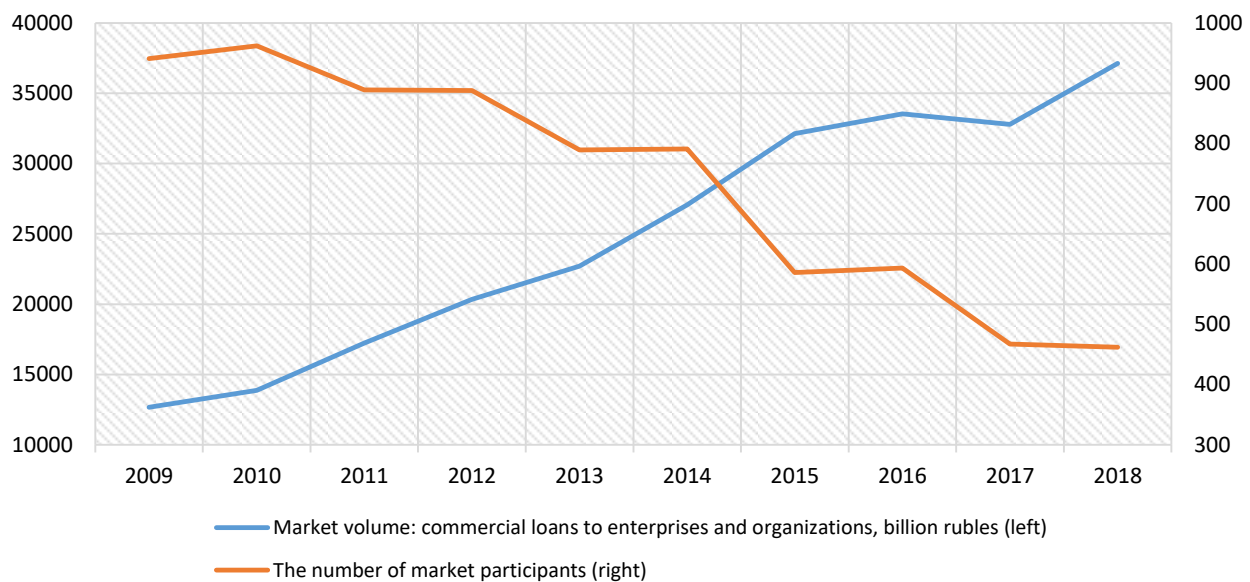


where  $R(a < f < BL_i)$  is probability within the range of the initial threshold value  $a$  and the boundary level  $BL$ ;  $L(z)$  is the Laplace function;  $a$  is the initial threshold value;  $\bar{f}(CP_i)$  is the indicator's average value for the period under consideration;  $\delta(CP_i)$  is the indicator's standard deviation for the period under consideration.

The research limitations of the approach reside in a number of provisions. The boundary level is a subjective characteristic and can vary. The quality and accuracy of the probability estimates are also affected by the completeness of the data collection. In the situations, where the period under consideration is short, the statistics of the current level of industry concentration coefficients and indices will be incomplete, and the correctness of the estimates of the market type is low.

#### 4. Results

To analyze concentration of the banking sector in Russia and establish the type of industry market, we should look at actual market data for the decade from 2009 to 2018 (Fig. 1). The main source data for the calculation are the market volume defined as a sum of commercial loans issued to enterprises and organizations by Russian banks during the reporting period.



**Fig. 1.** The volume of commercial banking lending market in Russia

*Source:* the data of the Central Bank of Russia.

The volume of commercial banking lending market in Russia experienced a steady growth throughout almost the whole period. A temporary decline in 2017 did not break the general trend and, as a result, it can be ignored. For the purpose of our study, the dynamics of the market volume is considered monotone positive. At the same time, the number of market participants is characterized by the dynamics opposite to that of the market volume. The number of players demonstrates a clear downward trend with several local “breakdowns” happening once every two years, i.e. the compression rate is reducing. The Russian banking system consists of a relatively large number of participants: there were 462 of them in 2018. The market is dominated by several large partly state-owned banks that hold about half of all banking assets (Anisimova and Vernikov, 2011; Chernikova and Zaernyuk, 2011), which is confirmed by official statistics. [Rezbaev (2013) hypothesizes that high concentration of assets in Russia during 2013–2015 was due to the lack of a clear concept for managing the federal treasury’s liquidity,



which resulted in the need to involve commercial banks in handling accounts of budgets of various levels and, primarily, the federal budget.] This process occurs firstly due to the fact that large banks increase their assets at a faster rate than small and medium-sized banks. This is a special feature of the Russian case of consolidation in comparison with consolidation of banking assets in developed countries. It is important to bear in mind that Russian banks are frequently interconnected through cross-ownership of shares or a single owner. This circumstance somewhat distorts the real picture of competition in the market.

Let us analyze concentration of the banking sector in Russia using industry indicators. The results of the calculations are supplied in Appendix A.

There was a constant upward trend in the concentration ratio during almost the entire period. This can be traced equally, and, therefore, is true for the values of the concentration ratios  $CR3$ ,  $CR4$ ,  $CR6$  and  $CR8$ . Throughout the period under consideration, the values of  $CR3$  fall within the range that corresponds to the boundaries of oligopoly (see Table 3). At that, there is observed a monotone approximation to the upper boundary of oligopoly/lower boundary of monopoly. In other words, if the dynamic persists, the market is expected to become monopolistic. Moreover, during the last two years of the period under discussion, this trend is present in  $CR8$ . Nevertheless, the concentration ratio of 2009–2018 indicates that the sector is oligopolistic. Now let us compare this conclusion with the data provided by other indicators. The relative concentration ratio displays inverse dynamics with respect to the concentration ratio. The values of the relative concentration ratio are in the range that corresponds to the boundaries of monopoly, while the general dynamics indicates its strengthening.

The Herfindahl-Hirschman index is directly related to the concentration ratio.  $HHI$  shows a steady growth. The values of the Herfindahl-Hirschman index are in the range of oligopoly boundaries. At that, the general dynamics of the period allows asserting that, if the trend persists, in the near future the lower boundary of monopoly (level 1800) will be forced. If the Herfindahl-Hirschman index indicates a certain type of industry market which contradicts the conclusions on other indicators, then the final decision on the type of market is made taking into account additional data.

According to the data obtained, the variance of market shares of participants in the Russian banking market increases along with the increase in the concentration ratio. For the purpose of the current analysis, the dynamics of the market share dispersion is considered monotone positive. Throughout the entire period under discussion, the values of the market share dispersion exceed 1, which indicates a monopoly market.

The inverse share value index demonstrates multidirectional, extremely unstable (near-sinusoidal) dynamics, which does not correlate with the dynamics of any of the indicators described above, including the concentration ratio. However, throughout the entire period of 2009–2018, the values of the index vary within the range of a monopoly type of market.

The dynamics of the coefficient of variation completely follows the dynamics of the concentration ratio. It grew during almost the whole period (excluding 2010 and 2016).

The values of the Gini Index during the period under review are within the range of the monopoly boundaries. At that, the general dynamics allows asserting that, if the trend continues, the movement will occur away from the lower limit of monopoly.

The maximum share index shows inverse dynamics in relation to the concentration ratio. The values of the index correspond to the monopoly boundaries. The index is expected to change towards the strengthening of monopoly, although in absolute terms, this change is insignificant and the values fluctuate around 0.99.

A different type of market is determined by the Hall-Tideman index. As the concentration ratio increases, so does the index, its dynamics is monotone positive. The index's level corresponds to monopolistic competition. The general dynamics makes it possible to claim that, if the emerging trend persists, the movement will occur towards the lower boundary of oligopoly. It is noteworthy that monopolistic competition here is in conflict with the type of market determined by the majority of other indicators.

The Linda's index is characterized by multidirectional, unstable dynamics in relation to the dynamics of the concentration ratio. It rose at the beginning of the period and declined at the end of the period. The Linda's index at the beginning of 2009–2013 was over 15 ( $>15$ ), which corresponded to monopolistic competition; in 2014–2018, it did not exceed 15, which indicated the oligopolistic type of market.

Thus, we can see that determining the type of industry market with the help of individual characterizing indicators leads to ambiguous and sometimes contradictory results. To arrive at the conclusion about the aggregated type of an industry market, we apply the probability approach and integration based on the root mean square. The calculated data are given in Table 4.

**Table 4.** Probability distribution of the main indicators of an industry market's concentration for the banking sector of commercial lending in Russia for 2009–2018

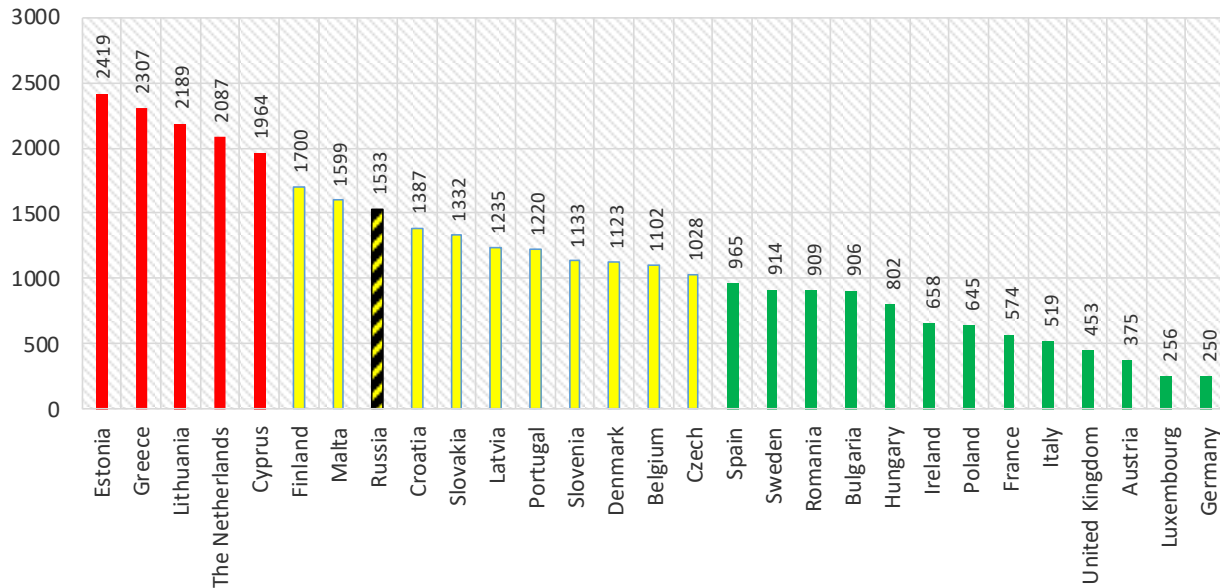
Index/coefficient	Monopoly	Oligopoly	Monopolistic competition
Concentration ratio $CR_3$	0.00	96.92	3.08
Relative concentration ratio $CRR_3$	99.99	0.01	0.00
The Herfindahl-Hirschman index $HHI$	0.04	99.79	0.17
Dispersion of market share distribution	0.00	0.00	100.00
The Gini index	100.00	0.00	0.00
The Hall-Tideman index $HT$	0.00	0.00	100.00
Relative entropy $E_R$	0.00	100.00	0.00
The maximum share index	100.00	0.00	0.00
The Linda's index	4.22	39.08	56.70
The inverse share value index	99.34	0.66	0.00
Root mean square	63.15	55.57	48.19

Source: calculated by the authors

As shown in Table 4, the maximum root mean square indicates a monopolistic type of market. Within the framework of the present analysis, this result will be considered aggregated and final.

## 5. Discussion

The Herfindahl-Hirschman index can be applied to perform a comparative regional analysis of the concentration level of homogenous markets. Look at the state of the banking industry in Russia and the EA/EU macroregion in 2009–2017 (Fig. 2; Appendix B). The EA/EU macroregion is a number of states included in the European Union and/or using euro as the official currency.



**Fig. 2.** The concentration level in the banking industry of the EA/EU and Russia in 2017 by the Herfindahl-Hirschman index (*HHI*)

*Source:* the data of the Eurostat, calculated by the authors.

As the data obtained show, the Herfindahl-Hirschman index of the banking industry in Russia falls within the boundaries of oligopoly. Fig. 2 illustrates that the banking sectors of only a few countries in the EA/EU region can be classified as monopolistic, namely Finland, Estonia, the Netherlands, Lithuania, and from the second half of the period under review – Malta and Cyprus. The Herfindahl-Hirschman index classifies the majority of the EA/EU banking sectors as monopolistic competition. These are primarily Germany, Luxemburg and Austria, where the concentration level of the banking sector is minimal.

While describing the dynamics of the banking sectors' development, it is worth noting that the countries with the maximum monopoly (Finland and Estonia) are characterized by a downward trend in the concentration level and in the future are likely to enter the zone of oligopoly, if the planned trends continue. The opposite situation is typical to the banking sector in Russia that demonstrates a virtually monotone growth in the concentration level. Although it remains in the oligopoly zone, if the planned trends persist, in the near future it can be considered completely monopolistic.

## Conclusions

Economic stability emerges under the influence a complex set of factors and conditions that among other things include the sectoral concentration of banks. From the perspective of volumes, a powerful segment is the market of bank loans (loans to enterprises and organizations). The ratio of bank loans to a country's GDP is a key factor in the economic development. As with any sectoral market, the banking service market needs to maintain competition and prevent monopolism. Traditionally, concentration is assessed according to quantitative indicators, such as the concentration ratio, the Herfindahl-Hirschman index, the entropy index, the indices of Linda, Gini and Hall-Tideman, dispersion of market share distribution, the coefficient of variation, etc.

To generalize about the calculated indices, we used an integrated calculation based on the Laplace distribution function. The method allowed us to calculate the probability value of attributing the Russian banking sector to a

particular type of industry market. We found that, despite a relatively large number of participants in the banking market in Russia, it should be more closely identified with a monopoly. At the same time, the values of the Herfindahl-Hirschman index, the standard concentration and some other indices are within the boundaries of oligopoly. This indicates that the nature of the sectoral market is fuzzy.

While comparing Russia with the EA/EU nations, we arrived at the following conclusions. Firstly, according to the Herfindahl-Hirschman index, the banking sectors of the majority of the EA/EU states are identified with monopolistic competition (Germany, Luxemburg, Austria, etc.). Secondly, the EA/EU countries with monopolistic banking sectors (Finland, Estonia, etc.) demonstrate a downward trend in the concentration level and in the future are likely to enter the zone of oligopoly, if the planned trends continue. Thirdly, the banking sector in Russia demonstrates a virtually monotone growth in the concentration level. Although it remains within the oligopoly zone, if the planned trends persist, in the near future it will be considered completely monopolistic.

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### References

- Aliev, I. A. (2017). The structural method to assess competition in the Russian banking sector. *Financial Life*, 3, 15-19.
- Anisimova, A. I., Vernikov, A. V. (2011). The structure of the banking services market and its impact on competition (the case of two Russian regions). *Money and Credit*, 11, 53-62.
- Anzoátegui, D., Martínez Peria, M. S., Melecky, M. (2010). Banking sector competition in Russia. *Policy Research Working Paper WPS5449*. The World Bank, October 2010. <https://doi.org/10.1596/1813-9450-5363>
- Avdasheva, S. B., Rozanova, N. M. (1998). *Theory of industry markets organization*. Moscow: Magistr.
- Ayadi, R. (2008). Banking Mergers and Acquisitions' Performance in Europe. In: Molyneux P., Vasselado E. (eds) *Frontiers of Banks in a Global Economy*. Palgrave Macmillan Studies in Banking and Financial Institutions. London: Palgrave Macmillan. [https://doi.org/10.1057/9780230590663\\_2](https://doi.org/10.1057/9780230590663_2)
- Basten, M., Sánchez, S. A. (2018). European banks after the global financial crisis: a new landscape. *Journal of Banking Regulation*, No. 600, 1-23. <https://doi.org/10.1057/s41261-018-0066-3>
- Beck, T., Demirgüç-Kunt, A., Levine, R. (2006). Bank Concentration, Competition, and Crises: First Results. *Journal of Banking and Finance*, 30(May), 1581-1603. <https://doi.org/10.1016/j.jbankfin.2005.05.010>
- Bening, V. E., Korolyov, V. Yu. (2008). Some statistical problems associated with the Laplace distribution. *Informatics and Applications*, 2(2), 19-34.
- Berger, A. N. (2003). The Economic Effects of Technological Progress: Evidence from the Banking Industry. *Journal of Money, Credit and Banking*, 35(2), 141-176. <https://doi.org/10.1353/mcb.2003.0009>
- Berger, A. N., Demselz, R. S., Strahan, P. E. (1999). The Consolidation of the Financial Services Industry: Causes, Consequences, and Implications for the Future. *Journal of Banking and Finance*, 23, 135-194. [https://doi.org/10.1016/S0378-4266\(98\)00125-3](https://doi.org/10.1016/S0378-4266(98)00125-3)
- Besanko, D., Dranove, D., Shanley, M., Schaefer, S. (2009). *Economics of Strategy*. New York: John Wiley and Sons.
- Bikker, J. A. (2004). *Competition and Efficiency in a Unified European Banking Market*. Edward Elgar Publishing.

- Bikker, J., Haaf, K. (2001). Measures of competition and concentration in the banking industry: A review of the literature. *Economic & Financial Modeling*, 9, 53-98.
- Black, S., Strahan, P. (2000). *Entrepreneurship and the structure of the banking industry*. Mimeo.
- Blanco, L. O. (2011). *Market Power in EU Antitrust Law*. Bloomsbury Publishing.
- Bonaccorsi, D., Dell’Ariccia, G. (2000). *Bank competition and firm creation*. Mimeo.
- Cetorelli, N. (2004). Real Effects of Bank Competition. *Journal of Money, Credit, and Banking*, 36(3), 543-558. <https://doi.org/10.1353/mcb.2004.0043>
- Cetorelli, N., Strahan, P. E. (2006). Finance As a Barrier to Entry: Bank Competition and Industry Structure. *Journal of Finance*, 61(1), 437-461. <https://doi.org/10.1111/j.1540-6261.2006.00841.x>
- Chernikova, L. I., Zaernyyuk, V. M. (2011). Institutional peculiarities of the development of the Russian banking sector. *Service Plus*, 1, 113-118.
- Clarke, R., Davies, S., Waterson, M. (1984). The profitability-concentration relation: market power or efficiency? *Journal of Industrial Economics*, 32(4), 435-450. <https://doi.org/10.2307/2098228>
- Coccorese, P. (2009). Market power in local banking monopolies. *Journal of Banking & Finance*, 33(7), pp. 1196-1210. <https://doi.org/10.1016/j.jbankfin.2008.12.013>
- Collender, R., Shaffer, S. (2000). Local bank office ownership, deposit control, market structure, and economic growth. *Technical bulletin of U.S. Department of Agriculture No. 1886*. <https://doi.org/10.2139/ssrn.236038>
- Coricelli, F., Marc, M. (2010). Are Product Market Structures Affected by Banking Concentration: Evidence from Transition Countries. In: Matousek R. (eds) *Money, Banking and Financial Markets in Central and Eastern Europe*. Palgrave Macmillan Studies in Banking and Financial Institutions. London: Palgrave Macmillan. [https://doi.org/10.1057/9780230302211\\_3](https://doi.org/10.1057/9780230302211_3)
- Cowell, F. (2011). *Measuring inequality*. Oxford University Press. <https://doi.org/10.1093/acprof:osobl/9780199594030.001.0001>
- DeYoung, R., Hunter, W. C., Udell, G. F. (2004). The Past, Present, and Probable Future for Community Banks. *Journal of Financial Services Research*, 25(2-3), 85-133. <https://doi.org/10.1023/B:FINA.0000020656.65653.79>
- Drobyshevsky, S. M., Paschenko, S. A. (2006). *Analysis of competition in the Russian banking sector. Scientific works of the Institute for the Economy in Transition No. 96P*. Moscow: IEPP Publ.
- Edwards, F. R., Patrick, H. T. (2012). *Regulating International Financial Markets: Issues and Policies*. Springer Science & Business Media.
- Ely, D. P., Robinson, K. J. (2005). Consolidation, Technology, and the Changing Structure of Bank’s Small Business Lending. *Economic and Financial Review*, vol. Q1, 23-32.
- Ezrokh, Yu. S. (2013). Concentration as a macroeconomic trend in the development of competition environment of the domestic banking system. *Modern Competition*, 1(37), 89-102.
- Federal Antimonopoly Service of the Russian Federation order “On approval of the procedure for analyzing the state of competition in the commodity market” of April 28, 2010 No. 220. Retrieved from: <http://moscow.fas.gov.ru/page/6193>.
- González, V. M., González, F. (2008). Influence of bank concentration and institutions on capital structure: New international evidence. *Journal of Corporate Finance*, 14(4), 363-375. <https://doi.org/10.1016/j.jcorpfin.2008.03.010>
- Hall, M., Tideman, N. (1967). Measures of concentration. *Journal of the American Statistical Association*, 62(317), 162-168. <https://doi.org/10.1080/01621459.1967.10482897>
- Hellman, T., Da Rin, M. (2002). Banks as Catalysts for Industrialization. *Journal of Financial Intermediation*, 11(4), 366-97. <https://doi.org/10.1006/jfin.2002.0346>

- Hirschman, A. (1964). The Paternity of an Index. *The American Economic Review*, 54(5), 761-762. Retrieved from <http://www.jstor.org/stable/1818582>.
- Hoxh, I. (2013). The effect of banking market structure on the volatility of growth of manufacturing sectors in developing countries. *Journal of Economics and Finance*, 37(4), 528-546. <https://doi.org/10.1007/s12197-011-9189-4>
- Idzik, M. (2017). Banking Diversity and Trust in Banking Services. In: Miklaszewska E. (eds) *Institutional Diversity in Banking. Palgrave Macmillan Studies in Banking and Financial Institutions*. Cham: Palgrave Macmillan. [https://doi.org/10.1007/978-3-319-42073-8\\_9](https://doi.org/10.1007/978-3-319-42073-8_9)
- Jayarathne, J., Strahan, P. (1996). The finance growth nexus: Evidence from bank branch deregulation. *Quarterly Journal of Economics*, 111, 639-670. <https://doi.org/10.2307/2946668>
- Kotz, S., Kozubowski, T. J., Podgórski, K. (2001). Classical Symmetric Laplace Distribution. In: *The Laplace Distribution and Generalizations*. Boston, MA: Birkhäuser. <https://doi.org/10.1007/978-1-4612-0173-1>
- Krylova, L. V. (2009a). Modern trends in the development of concentration processes in Russia's banking capital. *Finance and Credit*, 12(348), 33-40.
- Krylova, L. V. (2009b). Special features of centralization of bank capital in Russia. *Financial Analytics: Science and Experience*, 4(16), 24-33.
- Kuzmin, E. A. (2018). Data on empirically estimated corporate survival rate in Russia. *Data in Brief*, 16(February), 850-864. <https://doi.org/10.1016/j.dib.2017.12.011>
- Kuzmin, E.A., Volkova, E. A., Fomina, A. V. (2019). Research on the Concentration of Companies in the Electric Power Market of Russia. *International Journal of Energy Economics and Policy*, 9(1), 130-136. <https://doi.org/10.32479/ijeep.7169>
- Law, S. H., Singh, N. (2014). Does too much finance harm economic growth? *Journal of Banking and Finance*, 41, 36-44. <https://doi.org/10.1016/j.jbankfin.2013.12.020>
- Legacy Square Capital*. (2017). The banking sector in Russia. Retrieved from: <http://ru.legacysquarecapital.com/marketing-materials/analytical-info/bankovskiy-sektor-rossii/>.
- Linda, R. (1976). *Methodology of concentration analysis applied to the study of industries and market*. Washington, D.C.: Commission of the European Communities.
- Lorenz, M. (1905). Methods of Measuring the Concentration of Wealth. *Publications of the American Statistical Association*, 9(70), 209-219. <https://doi.org/10.2307/2276207>
- Mamonov, M., Pankova, V., Akhmetov, R., Pestova, A., Solntsev, O. (2017). *The impact of financial sector development on economic growth and its volatility. Analytical note No. 8, July*. Moscow: The Center for Macroeconomic Analysis and Short-term Forecasting of the Central Bank of Russia.
- Marinč, M. (2013). Banks and information technology: marketability vs. relationships. *Electronic Commerce Research*, 13(1), March, 71-101. <https://doi.org/10.1007/s10660-013-9107-2>
- Medvedev, D. (2015). New reality: Russia and global challenges. *Russian Journal of Economics*, 10, 5-29. <https://doi.org/10.1016/j.ruje.2015.11.004>
- Mishkin, F. S. (1992). Anatomy of a Financial Crisis. *Journal of Evolutionary Economics*, 2, 115-130. <https://doi.org/10.1007/BF01193536>
- Moiseev, S. R. (2008). Effects of banking concentration. *Modern Competition*, 1(7), 103-112.
- Mukhametshina, N. A. (2014). Trends in the development of the banking market of corporate lending. *Siberian Financial School*, 5(106), 92-96.
- Neuberger, D., Pedergrana, M., Rähke-Döppner, S. (2008). Concentration of Banking Relationships in Switzerland: The Result of Firm Structure or Banking Market Structure? *Journal of Financial Services Research*, 33(2), 101-126. <https://doi.org/10.1007/s10693-008-0026-7>



- Pagano, M. (1993). Financial Markets and Growth. An Overview. *European Economic Review*, 37, 613-622. [https://doi.org/10.1016/0014-2921\(93\)90051-B](https://doi.org/10.1016/0014-2921(93)90051-B)
- Pak, O., Iwata, K. (2018). A path to financial integration: steps for the Eurasian Economic Union. *Asia Europe Journal*, 1-17. <https://doi.org/10.1007/s10308-018-00531-1>
- Pawłowska, M. (2017). The Role of Competitive Framework for Sound Banking Sector in the EU-15 and the EU-12. In: Miklaszewska E. (eds) *Institutional Diversity in Banking*. Palgrave Macmillan Studies in Banking and Financial Institutions. Cham: Palgrave Macmillan. [https://doi.org/10.1007/978-3-319-42073-8\\_8](https://doi.org/10.1007/978-3-319-42073-8_8)
- Peláez, C. M., Peláez, C. A. (2009). Bank Concentration and Central Banks. In: *Financial Regulation after the Global Recession*. London: Palgrave Macmillan. <https://doi.org/10.1057/9780230251243>
- Petersen, M., Rajan, R. (1995). The effect of credit market competition on lending relationship. *Quarterly Journal of Economics*, 110, 407-443. <https://doi.org/10.2307/2118445>
- Rezbaev, V. M. (2013). On problems of modernization, restructuring and reform of the banking system in 2013-2015. *Bulletin of Ufa State Oil Technical University. Science, Education, Economy. Series: Economics*, 3(5), 14-18.
- Rezitis, A. (2010). Evaluating the state of competition of the Greek banking industry. *International Financial Markets, Institutions and Money*, 20(1), 68-90. <https://doi.org/10.1016/j.intfin.2009.10.001>
- Schlossberg, R. (2004). *Mergers and acquisitions: understanding the antitrust issues*. Chicago, ABA Section of Antitrust Law.
- Shaffer, S. (1998). The winner's curse in banking. *Journal of Financial Intermediation*, 7(4), 359-392. <https://doi.org/10.1006/jfin.1998.0251>
- Shannon, C. E. (1948). A Mathematical Theory of Communication. *Bell System Technical Journal*, 27, 379-423. <https://doi.org/10.1002/j.1538-7305.1948.tb01338.x>
- Shikimi, M. (2013). Do firms benefit from multiple banking relationships? Evidence from small and medium-sized firms in Japan. *International Economics and Economic Policy*, 2013, 10(1), 127-157. <https://doi.org/10.1007/s10368-011-0196-x>
- Shtapova, I. S. (2009). Methodological approaches to assessing the structure of the industry market. *Bulletin of the Novosibirsk State University. Series: Socio-Economic Sciences*, 9(3), 59-67.
- Simoguk, S. N. (2013). The regulatory function of the central bank as an instrument of state monetary policy. *Actual Problems on Economics and Law*, 3(27), 43-47.
- Sviryzdenka, K., Yousefi, S. R. (2015). Rethinking Financial Deepening: Stability and Growth in Emerging Markets. *IMF staff Discussion Note. SDN/15/08*.
- Teresienė, D. (2018). Performance measurement issues in central banks. *Entrepreneurship and Sustainability Issues*, 6(1), 176-189. [http://doi.org/10.9770/jesi.2018.6.1\(12\)](http://doi.org/10.9770/jesi.2018.6.1(12))
- Tvaronavičienė, M., Masood, O., Javaria, K. (2018). Preconditions of the Eurozone economic security: how to overcome liquidity risk and cost inefficiency in leading banks of UK and Germany. *Polish Journal of Management Studies*, 18(1), 418-427. <http://doi.org/10.17512/pjms.2018.18.1.31>
- Van Hoose, D. (2017). The Industrial Economics of Banking. In: *The Industrial Organization of Banking*. Berlin, Heidelberg: Springer. <https://doi.org/10.1007/978-3-662-54326-9>
- Vishnever, V. Ya. (2006). The economic content of concentration and centralization of banking capital. *Journal of the Orenburg State Agrarian University*, 4(12), 99-103.



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## Appendix A

**Table A1.** Sectoral coefficients and indices of the Russian commercial banking lending for the period of 2008–2018

Indicator	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Concentration ratio $CR_3$	50.6%	46.9%	47.9%	50.3%	51.5%	52.6%	54.6%	55.9%	58.6%	60.9%
Concentration ratio $CR_4$	54.7%	51.5%	52.5%	54.6%	55.9%	56.9%	60.7%	62.1%	63.3%	65.6%
Concentration ratio $CR_6$	60.7%	58.2%	59.1%	60.8%	63.0%	64.0%	68.8%	69.9%	71.7%	73.9%
Concentration ratio $CR_8$	64.5%	62.2%	62.9%	64.4%	66.7%	68.1%	73.6%	74.7%	76.9%	78.7%
Relative concentration ratio $CRR_3$	0.41	0.45	0.44	0.42	0.41	0.40	0.39	0.38	0.37	0.36
Relative concentration ratio $CRR_4$	0.39	0.41	0.41	0.39	0.38	0.38	0.36	0.35	0.36	0.34
Relative concentration ratio $CRR_6$	0.36	0.38	0.37	0.36	0.35	0.35	0.34	0.33	0.33	0.32
Relative concentration ratio $CRR_8$	0.35	0.36	0.36	0.35	0.35	0.34	0.33	0.32	0.33	0.32
The Herfindahl-Hirschman index $HHI$	1337.5	1182.4	1186.1	1310.6	1309.2	1389.6	1461.9	1434.2	1533.0	1584.1
Dispersion of market share distribution	1.41	1.22	1.32	1.46	1.64	1.74	2.47	2.39	3.24	3.38
The coefficient of variation (dispersion)	0.13%	0.11%	0.13%	0.14%	0.16%	0.17%	0.27%	0.26%	0.39%	0.40%
The Gini index	0.94	0.93	0.93	0.93	0.93	0.94	0.95	0.95	0.95	0.96
The Hall-Tideman index $HT$	0.017	0.015	0.017	0.016	0.019	0.020	0.033	0.034	0.044	0.049
Absolute entropy $E$	3.42	3.57	3.52	3.46	3.37	3.30	3.00	2.98	2.83	2.74
Relative entropy $E_R$	49.9%	51.9%	51.8%	50.9%	50.6%	49.4%	47.1%	46.6%	45.9%	44.6%
The maximum share index	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
The Linda's index	19	18	27	27	26	9	11	9	10	7

Indicator	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
The inverse share value index	0.1937	0.0223	0.1302	0.0353	0.1575	0.0316	0.0392	0.0216	0.0120	0.1674

Source: Calculated by the authors using the data provided by the Central Bank of Russia

## Appendix B

**Table B1.** The values of the Herfindahl-Hirschman Index (*HHI*) of a number of EA/EU countries and Russia in the banking sector for the period of 2009–2017

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
Estonia	3090	2929	2613	2493	2483	2445	2409	2406	2419
Greece	1183	1214	1278	1487	2136	2195	2254	2332	2307
Lithuania	1693	1545	1871	1749	1892	1818	1939	1938	2189
The Netherlands	2034	2049	2067	2026	2105	2131	2104	2097	2087
Cyprus	1085	1125	1030	1007	1645	1445	1443	1366	1964
Finland	3480	3830	3880	3250	3410	3630	3160	2300	1700
Malta	1250	1181	1203	1313	1458	1648	1620	1602	1599
Russia*	1337	1182	1186	1311	1309	1390	1462	1434	1533
Croatia	-	-	-	-	1384	1364	1396	1405	1387
Slovakia	1273	1239	1268	1221	1215	1221	1250	1264	1332
Latvia	1181	1005	929	1027	1037	1001	1033	1080	1235
Portugal	1150	1207	1206	1191	1197	1164	1215	1181	1220
Slovenia	1256	1160	1142	1115	1045	1026	1077	1147	1133
Denmark	1042	1077	1192	1130	1160	1190	1180	1224	1123
Belgium	1622	1439	1294	1061	979	981	998	1017	1102
Czech	1032	1045	1014	999	999	949	987	1009	1028
Spain	507	528	596	654	719	839	896	937	965
Sweden	899	860	863	853	876	880	866	845	914
Romania	857	871	878	852	821	797	860	894	909
Bulgaria	846	789	766	738	730	836	919	939	906
Hungary	864	828	848	873	862	792	763	787	802
Ireland	714	700	645	630	671	673	672	636	658
Poland	574	559	563	568	586	656	670	659	645
France	605	610	600	545	568	584	589	572	574
Italy	298	410	407	410	406	424	435	452	519
United Kingdom	467	523	519	527	525	462	438	422	453
Austria	414	383	423	395	405	412	397	358	375
Luxembourg	310	343	346	345	357	330	321	260	256
Germany	206	301	317	307	266	300	273	277	250

Source: Eurostat; calculated by the authors

Note. The color scale shows an increase in the index from green (minimum) to red (maximum); for Russia, the HHI is calculated by the amount of commercial loans issued by banks.

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### SELECTED RISKS PERCEIVED BY SMEs RELATED TO SUSTAINABLE ENTREPRENEURSHIP IN CASE OF ENGAGEMENT INTO CLUSTER COOPERATION\*

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**Abstract.** Small and medium enterprises carry out their activities in a dynamic environment that is affected by various processes that also impact their sustainability. The future has the companies that are able to respond promptly to the challenges and are able to exploit opportunities sufficiently. One form of modern entrepreneurship that could help SMEs' sustainability in this environment is the cluster cooperation. This form of entrepreneurship brings many positive effects, but is also affected by various risks. The main aim of this study is to assess the perception of selected business risks that have an impact on SMEs' engagement into cluster cooperation. Using the questionnaire surveys of 1004 SMEs the perception was evaluated with emphasis on the differences between micro-small- and medium sized enterprises. From the data obtained, the tendencies are exposed through the evaluation of following risk categories such as: Market risks, Relation risks, Common resources risks, Operational risks, and Competency risks being assigned by a particular risk indicator afterwards. The final evaluation being made upon all respondents' answers analysis has confirmed that the competition risk turned out to be the most important risk indicator.

**Keywords:** cluster cooperation; small and medium enterprises; risk

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### 1. Introduction

The competitiveness of countries is determined by the ability of companies to succeed on global markets and to maintain their competitiveness. After industrialization reached its saturation in developed countries and percentage of value added generated by agricultural sector diminished, development economists' discussion turned field of efficiency of economic sectors, estimated by total factor productivity (Tvaronavičienė, 2014). The sustainable competitiveness of companies is currently being achieved and maintained mainly through innovation. This activity needs to manage specific business steps, therefore Kovaľová & Kulčár, (2017) recommended to use innovation management information systems. Innovation management system support the innovation implementation (Lewandowska & Stopa, 2018). Innovative business activities are seen as a highly interactive process in which intensive contacts with customers, suppliers, and various collaborations have a major impact on companies' ability to offer competitive solutions (Drulák & Druláková, 2014). These interactions make businesses tend to be geographically concentrated with many similarly sector-oriented businesses and institutions, and build mutually beneficial relationships, creating so-called clusters. The sector-oriented businesses with orientation on eco-innovations clusters are analysed by Stasiak-Betlejewska (2015). An example of a successful geographically localized cluster is a Silicon Valley in the USA (Obadi, Korcek, 2016).

Clustering firms can operate at a higher degree of efficiency and use the specialized assets of suppliers with shorter response times than when they operate in isolation. Spill-over effects and the interaction of companies with other stakeholders and customers create new ideas and increase pressure on innovation, with cluster environment reducing the cost of experimentation (Balaz & Hamara 2016). In cooperation with research and development especially small and medium-sized enterprises can achieve a higher degree of innovation (Adamowicz & Machla, 2016) and the difference between the growth of smaller firms and their larger counterparts can be even greater than without clustering (smaller firms grow mostly faster than larger ones (Fiala & Hedija, 2015)). The cluster environment also has a positive effect on the emergence of new and innovative companies that can connect to already existing relationships among individual cluster actors. Clusters, as groupings of actors in individual sectors, are considered by Cohesion Policy to be entities that can play a key role in regional development and sustainable competitiveness within the cooperation of stakeholders. In market economy, the competitiveness of regions depends on the competitiveness and economic growth of its actors in national economy.

The cluster concept represents a new direction in economic thinking. Brakman (2006) considers clustering to be a higher form of networking, bringing together the interests of the state, public and private spheres. For market economy development is according to Mura & Rózsa (2013) very important to create business networks, clusters and innovation. Already existing horizontal level networks have the possibility of linking to the vertical level in order to achieve a higher added value of their activity with a demonstrably positive impact on the development of the regions (Fojtiková, 2016). The key role of clusters in the initial phase is to analyze the development potential of the regions by linking their activities to effectively support economic activities as well as the economic growth of the territory through creating the horizontal and vertical links (Mura et al., 2017). An important aspect in cluster formation and goal definition is to build a cluster strategy involving actors from all sectors as their activities complement and influence each other. The members of developed clusters are mainly the representatives of SMEs. According Fabuš (2015), the key factor in economic development and growth of Slovakia are foreign

direct investments, which also affects the development of SMEs. Also, the incentives operating in the country through two ways of promoting investment environment, namely: EU structural funds which are translated directly to support small and medium enterprises, and development of infrastructure and manpower as well as other forms of state aid for the strategic investors at the regional level (Fabuš, 2014). Due to this fact, the clusters could contribute to the development of sustainable entrepreneurship of SMEs also in Slovak regions.

Only companies being able to respond promptly to challenges occurring under the current turbulent processes within the international business environment and exploit opportunities emerging from mutual collaboration based on innovation activities sufficiently can gain the benefits from the dominant position on market. One form of modern entrepreneurship that could enhance SMEs' sustainability in this environment is the cluster cooperation. That is why the research task of this study is focused on the perception assessment of selected business risks that have an impact on SMEs' engagement into cluster cooperation. This paper will discuss the issue how and in what way the form of entrepreneurship brings many positive effects, while being also affected by various risks. To put it in other words, this subject deals with the level of understanding regarding the five main sections of business risks having been considered by respondents in terms of involvement into cluster cooperation when highlighting sustainable entrepreneurship.

## **2. Clustering issues within entrepreneurship risk management and sustainability - Theoretical background**

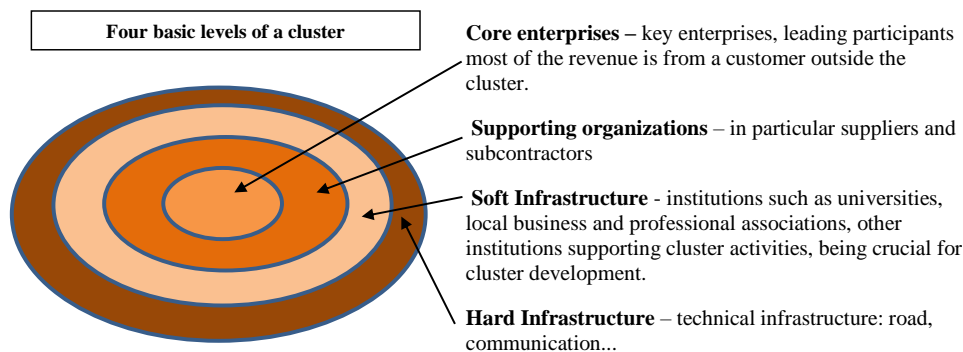
Globalization has always been a source of competitive advantage. International businesses have thus gained an advantage over domestic businesses. The new phase of globalization, on the contrary, increases the significance of the domestic base (Malec & Abraham, 2016). Previously, the size of the company was important, but today the size of the particular grouping within a cluster collaboration is getting more and more crucial (Burda, Abraham, Horvathova, 2017). That means that company can be even smaller, but it is important that it has enough good suppliers and supportive businesses and institutions around (Mura, Marchevska, Dubravka, 2018). This development of globalization puts emphasis on specialization, namely to make the specific things best done in specific locations. A new pattern of sustainable competition has emerged, which is based on innovation, modernization and specialization (Miklosik, Kuchta, Zak, 2018). Each locality can achieve a unique specialty when cooperating with mutual contractors. Competition rather means competition for share of opportunities, market share; that is why companies get together into clusters (Fojtikova & Stanickova, 2017; Hilkevics, Semakina, 2019).

Cluster was defined and implemented in 1990 by Michael E. Porter, but the issue of clusters is much older. Alfred Marshall, who formulated the theory of industrial districts, laid down the foundations of this issue in the 19<sup>th</sup> century. Michael E. Porter defined cluster as "a geographically close group of interconnected companies and related institutions in a particular field, linked by common features and complementarities" (Hamilton & Wepster, 2009). Thus, cluster can be understood as a geographically close group of affiliated companies and institutions in a certain area that cooperate and also compete with each other. Within the cluster, several types of entities can be grouped, such as research and education institutions, business enterprises, businesses providing different services to other enterprises within cluster, machine and production technology suppliers, suppliers of various parts and semi-finished products to the final product manufacturer (Cihelkova, 2016). Cluster brings together supply-chain relationships or joint technologies, possibly joint customers and distribution channels, or according to Horecký (2018) and Mészáros (2018) common labor markets and human capital (Lorincová, 2018; Žul'ová, Švec, Madleňák, 2018). Human resources are the one of important premises for realization of network creating. Due to the facts stated above, we can consider the clusters as the important tool for sustainable development of SMEs.

Significant term within the issue of clusters is the so-called Porter's diamond mode highlighting the competitive advantages of clusters, which do not depend on individual companies, but from the continuity of the entire cluster, the diamond. The diamond of competitive advantages consists of following major factors (Vojtovic, 2016):

conditions of entry factors, conditions of demand, related and supportive industries, strategy and rivalry of companies, the government.

Links among cluster actors can be conducted through three channels: material, personnel and information delivery/customer relations. There may also be a different hierarchy of links among individual cluster actors, thus creating different relationships, either on the basis of equivalence, or a major enterprise represents a central point linked to other enterprises by mutual ties (Varadzin, 2016). In addition, there may also be a multi-level hierarchy of suppliers when there is occurring a specializes of individual businesses on particular value chain levels, or so-called technological, non-hierarchical structure in which business relations focus primarily on personnel and information transfer (Taušer & Čajka, 2014). Cluster is an excellent tool how to achieve local, regional and national sustainable development, of which goal is to find common interest and matching being determined, as a high-performance cluster, by a collaboration at four basic levels, being shown below within the Figure 1.



**Fig. 1.** Four basic levels of a cluster

Source: own processing by Lipkova & Braga (2016).

Entry factor conditions are human resources, raw materials, knowledge, capital and infrastructure. Terms of demand create prerequisites for competition. Strategy and rivalry of companies are characterized by competition among companies (Sejkora, 2014). Related and supportive industries represent the ability of local companies to deliver cost-effective inputs and to participate in innovative business processes (Lemańska-Majdzik, Okreglicka 2015). The government, whether regional or national, affects individual parts of the diamond in a suitable competitive environment and encourages competitiveness by demand stimulation. Government should respond to the needs of clusters, such as promotion of innovation, research, development and education, or appropriate infrastructure creation (De Castro, Hnat, 2017). Balaz (2015) argues that clustering has a positive impact on innovation and competitiveness, capacity building and information, growth and sustainable business dynamics.

In each human activity, storylines and processes, and of course business activities, all activities are not carried out in the way the carrier plans for them, but they are being executed under conditions of uncertainty. The stage of uncertainty in specific conditions presents a risk. Risk is an important element that affects the safety of systems. It represents such a fact, which may unexpectedly bring up benefits but also cause a loss (Abrahám & Lžičar, 2018). The risk is associated especially within the distinction between planned and already achieved goals, as well as the

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possibility of invested funds loss. The investor gains significant decision-making power in the company where he invests. (Fabus & Csabay, 2018). Risks can be reduced by implementing preventive measures and risk-awareness (Machkova & Sato, 2017). The risk can be expressed in various ways (standard deviation, variation coefficient, frequency e.g. distribution function, relative difference between the actual and expected loss, etc.). The entrepreneur as a manager can have attitude to a risk: averse, neutral or may have a tendency to risk (Dano & Lesakova, 2018). In terms of entrepreneurial activity, the following types of risk can be determined: basic types of risk: business risk, the net risk; based on the substantive content: technical, manufacturing, economic, market, political risk; risk by binding to the businesses: systematic risks (e.g. changes caused by scientific and technological progress, increasing income tax rates, reduced purchasing power, electricity prices rising, etc.), non-systemic risks (e.g. non-conformity with technical progress, delays in product innovation, production facilities failure, etc.); risk in terms of its suggestibility: modifiable, uncontrollable risks and other risks. The business risk can be understood as a deviation of the actual economic result of entrepreneurship from planned results. Business risk can be characterized as the likelihood of taking a negative direction from reaching identified goals (Fabuš, 2017). By this term all activities or attributes will be understood, whose performance can cause negative consequences in an enterprise. All activities of an enterprise are derived from a strategy and therefore it is logical that a mistake in strategy brings impacts on all subsystems of an enterprise (Hanulakova & Dano, 2018; Zak, 2012). The uniqueness of industrial cooperation lies in the fact that it reduces the risk of failure in business, creates additional jobs, gives a positive experience and knowledge, and, therefore, it is a factor in the development of entrepreneurship (Fomina et al., 2018).

In economic practice of business entities, the activity the essence of which is the effective management of potential opportunities and possible undesirable consequences is called "the Risk management" (Tauser, Cajka, 2014). The basic assumption is that it must be an integral part of any management practice regardless of the management level. The risk management process includes risk identification, risk analysis and risk management planning (Sejkora & Sankot, 2017). Risk identification is determining which risks may affect the cluster activities. Possible problems in activities undertaken by a cluster are being identified. A risk most often is considered as the uncertainty of environmental factors impact on the functioning of organization and meeting its objectives. The risk can be seen from two perspectives: the existence of an external threat (external risks) and risk associated with its own activities (internal risks). Regarding the risk definition in clusters, it is necessary to have a look at this issue from two perspectives. The first aspect is the specificity of risk definition in particular bodies, and the second one is the specificity of cluster by itself (Zemanova & Drulakova, 2016).

In order to achieve the sustainability of business environment, especially in the area of small and medium-sized enterprises, a balanced and market-conforming strengthening and streamlining of the state's role is crucial within the implementation of allocation, distribution, stimulation and stabilization function of public finances by means of systemic formation and effective use of state budget and fiscal policy instruments (Zadrazilova, 2016; Okanazu, 2018). Evaluating the quality of the business environment appears to be another way to assess the level of the individual components of business environment. It is important to select appropriate indicators and select appropriate resources (Fabus, 2018). The aim is to create gradually the prerequisites for a knowledge-based growth of a society in consolidating macroeconomic stability and business development, with particular reference to job creation. The government's priority is such financial support for healthcare and social services that enhances their efficiency and quality. In upcoming years, policy areas will be a political priority for governments, with special regard to education, research and transport infrastructure (Vojtovic, Navickas, Gruzauskas, 2016). The microeconomic level of business environment sustainability is geared to changes within the production process and provided services. Businesses are trying to implement innovative processes and implement new technologies to achieve the sustainable business. Because of these changes, they market new products and services. They also follow new production links with foreign manufacturers and adjust their production program (Taušer, Arltová, Žamborský, 2015). Sale is another business tool. Its goal is to maintain original markets and to find new outlets. On the other hand, businesses set new sales conditions, adjusting prices and tariffs, and are



trying to shorten the delivery time for ordered goods and services (Lipkova, Hovorkova, 2018). Those are the ways to meet growing and sustainable business environment suitable for cluster collaboration development.

### 3. Problem Formulation and Methodology

The main research problem of this study was focused on the level of perception of the five main categories of business risks that respondents consider in case of engagement into cluster cooperation towards sustainable entrepreneurship. A subjective perception of risks was assigned by respondents on Likert scale from 0 – insignificant type of risk to 5 – the most important. Evaluated risk categories in this study are presented through the indicators that correspond with given category and with the connection into cluster cooperation. To state the risk categories and indicators we followed works from this research field of several authors (see table 1). The risk categories were selected by following Camarinha-Matos et al. (2015).

**Table 1** Risk factors in cluster cooperation

Risk category	RI	Risk indicator	Literature support
Market risks	RI1	Competition risk	Newlands (2003)
	RI2	Cluster production risk	Falkner&Hiebel (2015)
Relation risks	RI3	Trust risk	Rosa et al. (2015), Fomina et al. (2018)
	RI4	Communication risk	Camarinha-Matos et al. (2015)
	RI5	Organization risk - Cluster leaders' low ability of organization	Wang&Luo (2011)
Common resources risks	RI6	Human resources risk	Li&Geng (2012), Li et al. (2015), Subramanian et al. (2016)
	RI7	Financial resources risk	
	RI8	Material resources risk	
Operational risks	RI9	Information sharing risk	Berry (1997)
The risks of competitiveness	RI10	Quality risk	Camarinha-Matos et al. (2015)
	RI11	Cost risk	

Source: own research based on Camarinha-Matos et al. (2015)

In the research we focused on the findings, whether among the responses of SMEs, categorized by their sized category, the statistical significant differences are presented. To meet the main aim the quantitative method “analysis of variance” was used by following Hudáková & Masár (2018). The analysis of variance can be determined by the parametric or non-parametric tests. For using the calculation of the parametric tests two basic conditions had to be met: the resulting p-value of the intensity of the risks of the homoscedasticity test (identity of variances) and the normality test. If these conditions are not met, a nonparametric test is required.

We have used the Shapiro-Wilk test to verify normality, with a null hypothesis  $H_0$ : random selection  $X_1, X_2, \dots, X_n$  originates from a basic set with normal distribution against the alternative hypothesis  $H_1$ : the selection comes from a basic file with another layout. Calculated test statistic we compared to the corresponding p-value. In the case that the p-value is greater than the chosen significance level  $\alpha = 0.05$ , the hypothesis  $H_0$  is not rejected. Otherwise, we accepted alternative hypothesis  $H_1$  at the level of significance  $\alpha$ . The calculation was carried out in the program STATISTICA. To test the homogeneity of variance we have used the Levene's test. This test is used if  $k$  samples have equal variances. By Levene's test we tested null hypothesis  $H_0$ : We assume that variables in populations do not differ  $H_0: \sigma_1^2 = \sigma_2^2 = \dots = \sigma_n^2$  against alternative hypothesis  $H_1: \sigma_1^2 \neq \sigma_2^2 \neq \dots \neq \sigma_n^2$  that claims, that at least one pair of variances is different. The significance level is  $\alpha = 0.05$ . If the result of p-value is higher than  $\alpha$ , the  $H_0$  is accepted. In otherwise the  $H_1$  is valid.

Due to the results of normality testing by using Shapiro-Wilks test and its correction Lilliefors and p-values for each item, we used the non-parametric test – Kruskal Wallis (one-way analysis of variance by ranks) that is testing equality of population medians among groups. This test was used to compare mean and variability of more

than two groups. In this study the non-parametric Kruskal Wallis Test was used to find the differences between size categories of SMEs with respect to various level of risk perception.

Statistical hypothesis are formulated as follow:

H0: ranks do not differ among groups H1: ranks differ among groups

In the case that the p-value is greater than the chosen significance level  $\alpha = 0.05$ , the hypothesis H0 is not rejected. Otherwise, we accepted alternative hypothesis H1 at the level of significance  $\alpha$ . The calculation was carried out in the STATISTICA program.

#### 4. Results and discussion

The research was conducted in eight Slovak regions through questionnaire surveys in years 2016-2017. A total of 1004 owners or managers (competent persons) of small and medium enterprises (SMEs) were involved in our research. The participation on survey for SMEs was limited by their experience or knowledge of cluster cooperation. Next tables show the results of statistical analysis to each question of the survey. The structure of respondents presents table 2.

**Table 2.** The structure of respondents

Region	Size category of respondents			Total
	Micro (0-9 employees)	Small (10-49 employees)	Medium (50-249 employees)	
Bratislava	2,79%	3,78%	2,49%	<b>9,06%</b>
Trnava	2,79%	3,78%	2,49%	<b>9,06%</b>
Trenčín	18,73%	13,65%	6,27%	<b>38,65%</b>
Nitra	1,89%	1,59%	1,29%	<b>4,78%</b>
Zilina	10,96%	8,47%	3,88%	<b>23,31%</b>
Banská Bystrica	1,69%	1,20%	0,80%	<b>3,69%</b>
Košice	4,18%	3,29%	1,49%	<b>8,96%</b>
Prešov	1,20%	1,59%	0,40%	<b>3,19%</b>
<b>Total</b>	<b>44,62%</b>	<b>37,15%</b>	<b>18,23%</b>	

Source: own research

There is the necessary information for analysis of variance in each following tables. These are the basic statistical characteristics: the average of respondents' evaluation, the range of respondents' evaluation, standard deviation. There are also the results of used tests for verification of normality and the homogeneity of variance. The results of Levene's test and Shapiro-Wilk test showed the necessity of using nonparametric test – Kruskal Wallis Test (KW test).

The first evaluated category was Market risk. Within this category, two risk indicators were evaluated RI1 Competition risk and RI2 Cluster production risk. These risks are related to the sale of sustainable products or the providing of sustainable services. As the most risky indicator in this category was marked by respondents the RI1 mainly by micro ( $3.36 \pm 1.40$ ) and small ( $3.36 \pm 1.28$ ) enterprises. The risk indicator RI2 was important mainly for small enterprises ( $2.61 \pm 1.41$ ). Based on the results of KW test for RI1 (the p value is higher than 0.05) we can therefore claim that there are not the differences among the medians of respondents' evaluation of this risk indicator, with a confidence level of 95.0%. On the opposite side, for indicator RI2, the calculated p-value is lower than 0.05. We can therefore claim that the differences among the medians of respondents' evaluation of this risk indicator are statistically significant among the involved groups of respondents (with a confidence level of 95.0%).

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**Table 3.** The evaluation of Market risks

Market risks	Sized category	Mean	N	SD	Variance	Levene's test	Shapiro-Wilk test	Lilliefors	Kruskal Wallis test
R11	Micro (0-9 employees)	3.36	448	1.40	1.96	F=3.927 p=0.02	SW=0.889 p<0.00	p<0.01	H (2, N=1004) =0.360 p =0.835
	Small (10-49 employees)	3.36	373	1.28	1.64				
	Medium (50-249 employees)	3.45	183	1.20	1.45				
R12	Micro (0-9 employees)	2.36	448	1.41	1.98	F=0.006 p=0.99	SW=0.931 p<0.00	p<0.01	H (2, N=1004) =6.969 p =0.031
	Small (10-49 employees)	2.61	373	1.41	1.97				
	Medium (50-249 employees)	2.50	183	1.39	1.93				

Source: own research and processing in program STATISTICA

The second category – Relation risks, consists of three risk indicators: R13 Trust risk, R14 Communication risk and R15 Organization risk - Cluster leaders' low ability of organization (table 3). Good relationships among cluster' stakeholders and with customers are the basis for as well as stakeholders, as well as whole cluster towards their long-term sustainability. If we compared the respondents' evaluation of these risk indicators, we observed as the most important indicator R14. In the respondents' evaluation, according sized category, this risk indicator was the most important for small enterprises (3.11±1.49). The results of p-value of KW test for R13 and R14 are higher than 0.05. We can therefore claim, with a confidence level of 95.0%, that the differences among the medians of respondents' evaluation of these risk indicators are not statistically significant among the involved sized category of enterprises. It means, that size category of respondents doesn't affect their evaluation of stated indicators. The p-value of KW test, calculated in case of R15 showed lower level than the reference p - value is.. Therefore the differences among the medians of respondents' evaluation of this indicator are statistically significant. The respondents' evaluation of this indicator depends on the sized category of enterprise (table 4).

**Table 4.** The evaluation of Relation risks

Relation risks	Sized category	Mean	N	SD	Variance	Levene's test	Shapiro-Wilk test	Lilliefors	Kruskal Wallis test
R13	Micro (0-9 employees)	2.79	448	1.42	2.02	F=1.932 p=0.15	SW=0.925 p<0.00	p<0.01	H (2, N=1004) =1.430072 p =0.489
	Small (10-49 employees)	2.88	373	1.33	1.77				
	Medium (50-249 employees)	2.93	183	1.31	1.71				
R14	Micro (0-9 employees)	3.06	448	1.47	2.17	F=0.279 p=0.76	SW=0.907 p<0.00	p<0.01	H (2, N=1004) =0.3396103 p =0.844
	Small (10-49 employees)	3.11	373	1.49	2.22				
	Medium (50-249 employees)	3.07	183	1.48	2.18				
R15	Micro (0-9 employees)	2.33	448	1.47	2.17	F=0.379 p=0.68	SW=0.930 p<0.00	p<0.01	H (2, N=1004) =6.522256 p =0.038
	Small (10-49 employees)	2.49	373	1.51	2.27				
	Medium (50-249 employees)	2.65	183	1.53	2.34				

Source: own research and processing in program STATISTICA

Table 5 shows the results of respondents' evaluation of other three indicators from risk category of Common resources: R16 Human resources risk, R17 Financial resources risk and R18 Material resources risk. These three categories of resources are the key resources of each SMEs' sustainable entrepreneurship. The using of these resources towards sustainable entrepreneurship is linked with a certain level of risk. The highest average value of respondents' answers (3.16±1.43) was recorded for R16 by category of small entrepreneurs. The lowest average value we can see in case of R18 (2.38±1.56) evaluate by group of small enterprises. The results of p-values calculated by KW test are higher in all three cases than value of 0.05. We admit the 0.95 probability of reliability that among the individual responses of the respondents in the surveyed SMEs, the difference in mean values is not statistically significant.

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**Table 5.** The evaluation of Common resources risks

Common resources risks	Sized category	Mean	N	SD	Variance	Levene's test	Shapiro-Wilk test	Lilliefors	Kruskal Wallis test
RI6	Micro (0-9 employees)	3.00	448	1.51	2.28	F=0.040 p=0.96	SW=0.909 p<0.00	p<0.01	H (2, N=1004) =2.510538 p=0.285
	Small (10-49 employees)	3.16	373	1.43	2.04				
	Medium (50-249 employees)	3.01	183	1.51	2.29				
RI7	Micro (0-9 employees)	2.92	448	1.51	2.27	F=2.301 P=0.10	SW=0.910 p<0.00	p<0.01	H (2, N=1004) =2.612434 p=0.271
	Small (10-49 employees)	3.09	373	1.40	1.97				
	Medium (50-249 employees)	2.98	183	1.51	2.28				
RI8	Micro (0-9 employees)	2.40	448	1.61	2.61	F=0.553 p=0.58	SW=0.919 p<0.00	p<0.01	H (2, N=1004) =0.0745514 p=0.963
	Small (10-49 employees)	2.38	373	1.56	2.44				
	Medium (50-249 employees)	2.42	183	1.59	2.53				

Source: own research and processing in program STATISTICA

The comprehensive development of cluster stakeholders requires innovative cooperation based on the information sharing. The increasing of the dynamics of the meaning of creation and application of effective information systems will contribute to better customer satisfaction and response to market opportunity. Table 6 consists of evaluation of risk indicator RI9 Information sharing risk that was included in the category of Operational risks. This indicator considers respondents from category of small enterprises ( $2.77 \pm 1.41$ ) as the most important. The level of p-value of KW test is lower than 0.05, it means that ranks of respondents' differ among group according size category.

**Table 6.** The evaluation of Operational risks

Operational risks	Sized category	Mean	N	SD	Variance	Levene's test	Shapiro-Wilks test	Lilliefors	Kruskal Wallis test
RI9	Micro (0-9 employees)	2.49	448	1.42	2.02	F=0.482 p=0.62	SW=0.929 p<0.00	p<0.01	H (2, N=1004) =9.947492 p=0.007
	Small (10-49 employees)	2.77	373	1.41	1.98				
	Medium (50-249 employees)	2.52	183	1.43	2.03				

Source: own research and processing in program STATISTICA

The category of Competency risks consists of risk indicators R10 Quality risk and R11 Cost risk. The quality and cost are considered as the measures for the strategic objectives of enterprises. The RI10 was perceived as the most important in case of small enterprises ( $3.35 \pm 1.41$ ) and R11 by medium sized enterprises ( $3.02 \pm 1.48$ ). In case of RI10 the calculated p - value is higher than 0.05 and in the case of RI11 is lower. In case of RI10 the null hypothesis (H0: ranks do not differ among groups) was confirmed and in case of RI11 the alternative hypothesis (H1: ranks differ among groups of respondents) was accepted (table 7).

**Table 7.** The evaluation of Competency risks

Competency risks	Sized category	Mean	N	SD	Variance	Levene's test	Shapiro-Wilk test	Lilliefors	Kruskal Wallis test
RI10	Micro (0-9 employees)	3.24	448	1.51	2.29	F=2.154 p=0.12	SW=0.886 p<0.00	p<0,01	H (2, N=1004) =0,699 p=0,705
	Small (10-49 employees)	3.35	373	1.41	1.99				
	Medium (50-249 employees)	3.25	183	1.60	2.55				
RI11	Micro (0-9 employees)	2.76	448	1.43	2.05	F=0.678 p=0.51	SW=0.924, p<0.00	p<0,01	H (2, N=1004) =6,179 p=0,046
	Small (10-49 employees)	2.92	373	1.40	1.95				
	Medium (50-249 employees)	3.02	183	1.48	2.20				

Source: own research and processing in program STATISTICA

**Conclusions**

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The cluster cooperation towards sustainable entrepreneurship brings various risks. This is confirmed also by scientists who deal with this topic. Rosas et al. (2015) stated that there is the risk of dependence on the partner behavior for cooperation, Abhari et al. (2017) notice the risk of own reputation losing, Falkner & Hiebel (2015) argue that there is the risk of dependence on cluster production. Collective action may assist the prospect of success of individual firms but there is the risk it blunts initiative and inhibits competition (Newlands, 2003). Cluster cooperation allows the distribution of risks among cluster's stakeholders. The key aspect of this business is the relationship between competition and cooperation between firms and other actors within clusters (Newlands, 2003). The sustainable competitiveness of clusters is the ability to compete, growth, and to make profit from their products, services or other clusters' outputs, if the condition of quality, cost and appropriate use of resource are met. (see also Li&Geng, 2012, Li et al., 2015, Subramanian et al., 2016, Camarinha-Matos et al., 2015)

The results of our research showed the SMEs' perception of selected risk categories evaluated by risk indicators in the context of sustainable entrepreneurship. Table 8 shows the evaluation of risk indicators sorted by their importance based on the average value of respondents' answers. As we can see, all respondents (regardless of the size categorization of enterprise) stated that the most important risk indicators are RI1 Competition risk ( $3.38 \pm 1.32$ ) and RI10 Quality risk ( $3.28 \pm 1.49$ ). The least important is RI8 Material resources risk ( $2.40 \pm 1.59$ ).

**Table 8.** The ranking of risk indicators

RI	Risk indicator	Mean	Standard deviation
RI1	Competition risk	3.38	1.32
RI10	Quality risk	3.28	1.49
RI4	Communication risk	3.08	1.48
RI6	Human resources risk	3.06	1.48
RI7	Financial resources risk	3.00	1.47
RI11	Cost risk	2.86	1.43
RI3	Trust risk	2.85	1.37
RI9	Information sharing risk	2.60	1.42
RI2	Cluster production risk	2.48	1.41
RI5	Organization risk - Cluster leaders' low ability of organization	2.45	1.50
RI8	Material resources risk	2.40	1.59

*Source: own research*

Based on the results of realization of analysis of variance, when we used the non-parametric Kruskal-Wallis test, we can conclude, that significant statistical differences among respondents' answers we can observe in case of following risks indicators: **RI2** Cluster production risk, **RI5** Organization risk - Cluster leaders' low ability of organization, **RI9** Information sharing risk, **RI11** Cost risk. It means that assessment of this indicators depends on size category of respondents.

The application of risk management and specific risk management practices within clusters represent a spectrum of specific management activities application that influence the decision making, strategy, and operational activities of the cluster as a whole. The emphasis on a coordinated approach to risk is an effective way to increase the certainty that stakeholders have the desired effect on sustainable enterprise development. A good orientation in possible threats resulting from engagement in a cluster should enable the involved subject to help reduce these threats and subsequently suppress negative fallouts of a different environment in practice.

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### References:

- Abhari, K., Davidson, E., & Xiao, B. 2017. Perceived Individual Risk of Co-innovation in Collaborative Innovation Networks.
- Abbrám, J.; & Lžičař, P. 2018. Risk management in the sustainable development: Analysis of a selected key industry. *Journal of Security and Sustainability Issues*, 8(2): 171-180. [http://doi.org/10.9770/jssi.2018.8.2\(5\)](http://doi.org/10.9770/jssi.2018.8.2(5))
- Balaz, P. 2015. Japan's economy in the 21st century Trends and challenges, *Ekonomický Casopis*, 63(8): 869-872.
- Balaz P.; & Hamara A. 2016. Export dependency of Slovakia on German's economy. *Politická Ekonomie*, 64(5): 573-590. <http://doi.org/10.18267/j.polek.1088>
- Berry, A. 1997. *SME competitiveness: The power of networking and subcontracting*, Inter-American Development Bank.
- Brakman, S. [et al.]. 2006. *Nations and firms in the global economy - an introduction to international economics and business*. Cambridge: Cambridge University Press, 2006.
- Burda, P.; Abbrám, J.; & Horvathová, Z. 2017. Factors Influencing Online Civic Participation in Mid-Sized Czech Towns. *Transformations in Business & Economics*, 16(2B): 607-618.
- Camarinha-Matos, L. M., Bénaben, F., & Picard, W. 2015. *Risks and Resilience of Collaborative Networks*. Springer.
- Cihelková, E. 2016. Formation of the theoretical framework for the comparative analysis of post-socialist countries. *Agricultural Economics (Czech Republic)*, 62(9): 407-420. <http://doi.org/10.17221/18/2016-AGRICECON>
- Dano, F.; & Lesakova, D. 2018. The Role of Environmental Stimuli in Shopping Evaluation and Responses, *Ekonomický Casopis*, 66(5): 465-478.
- De Castro, T.; & Hnat, P. 2017. Czech FDI Performance: Between Global Value Chains and Domestic Reforms, *Foreign Direct Investment in Central and Eastern Europe: Post-Crisis Perspectives*, Book Series: Studies in Economic Transition, [http://doi.org/10.1007/978-3-319-40496-7\\_3](http://doi.org/10.1007/978-3-319-40496-7_3)
- Drulák, P.; & Druláková, R. 2014. The richness of the liberal tradition in international relations: Karl Deutsch on political community and the European integration. *International Relations*, 28(3): 333-349. <http://doi.org/10.1177/0047117814545951>
- Fabuš, M. 2017. Current development of business environment in Slovakia and Czech Republic. *Entrepreneurship and Sustainability Issues*, 5(1): 127-137.
- Fabus, M. 2018. Business environment analysis based on the Global Competitiveness Index (GCI) and Doing Business (DB): case study Slovakia. *Journal of Security and Sustainability Issues*, 7(4): 831-839. [http://doi.org/10.9770/jssi.2018.7.4\(18\)](http://doi.org/10.9770/jssi.2018.7.4(18))
- Fabus, M.; & Csabay, M. 2018. State aid and investment: case of Slovakia, *Entrepreneurship and Sustainability Issues*, 6(2): 480-488. [http://doi.org/10.9770/jesi.2018.6.2\(1\)](http://doi.org/10.9770/jesi.2018.6.2(1))
- Fabuš, Michal. 2014. Foreign direct investment and its impact on the Slovak Republic's economy. *Ekonomický časopis - XXI*, no. 9-10(1), 42-45.
- Fabuš, M. 2015. Impact of foreign direct investment on unemployment development in selected regions of Slovak Republic. *Economic Annals XXI*. Vol. 19, no. 155(11-12): 63-66.
- Falkner, E. M.; & Hiebl, M. R. 2015. Risk management in SMEs: a systematic review of available evidence, *The Journal of Risk Finance*, 16(2): 122-144.
- Fiala, R., Hedija, V. 2015. Gibrat's law and empirical studies. *Proceedings of the 10th International Scientific Conference Financial management of Firms and Financial Institutions*, 254-262.
- Fojtiková, L. 2016. Trends in the revealed comparative advantages of the EU member states, *Economic Annals-XXI*, 161(9-10): 7-11. <https://doi.org/10.21003/ea.V161-02>

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Fojtikova, L.; & Stanickova, M. 2017. The EU member states export competitiveness and productivity, *Politicka Ekonomie*, 65(6): 669-689. <http://doi.org/10.18267/j.polek.1169>

Fomina, A.; & Berduygina, O., & Shatsky, A. 2018. Industrial cooperation and its influence on sustainable economic growth. *Entrepreneurship and Sustainability Issues*, 5(3): 467-479.

Hamilton, L.; & Wepster, Ph. 2009. *The International Business Environment*, New York: Oxford University Press.

Hanulakova, E.; & Dano, F. 2018. Circular economy as a new managerial approach. *AD ALTA-Journal of Interdisciplinary Research*, 8(1): 95-98.

Hilkevics, S.; Semakina, V. 2019. The classification and comparison of business ratios analysis methods, *Insights into Regional Development* 1(1): 47-56. [http://doi.org/10.9770/IRD.2019.1.1\(4\)](http://doi.org/10.9770/IRD.2019.1.1(4))

Horecký, J. 2018. Operation and action of a trade union (in terms of Czech Republic labour law), *Central European Journal of Labour Law and Personnel Management*, 1(1): 17-27.

Hudáková, M.; & Masár, M. 2018. Research of Statistical Dependence of Perceived Personnel, Legal and Security Risks on the Size of SMEs in the Transport Sector, *Proceedings of 22nd International Scientific Conference. Transport Means 2018*. Ed. by Kersys, R. Kowno: Kaunas University of Technology, 1137 – 1141

Kovařová, M.; & Kulčár, L. 2017. Innovation management and information acquisition, *Acta Oeconomica Universitatis Selye*, 6 (2): 101-108

Lemańska-Majdzik, A.; & Okreglicka, M. 2015. Identification of Business Processes in an Enterprise Management. *Procedia Economics and Finance*, Vol. 27. In: 22<sup>nd</sup> International Economic Conference "Economic Prospects in the Context of Growing Global and Regional Interdependencies, 15-16.05.2015, Sibiu, Rumunia; 394-403

Lewandowska, A.; & Stopa, M. 2018. SMEs innovativeness and institutional support system: the local experiences in qualitative perspective. Polish case study, *Oeconomia Copernicana*, 9(2): 333-351

Lipkova, L.; & Braga, D. 2016. Measuring Commercialization Success of Innovations in the EU, *Marketing and Management of Innovations*, 4: 15-30.

Lipkova, L.; & Hovorkova, K. 2018. Economic situation in Norway after the outbreak of the global financial and oil crises in the context of EU integration trends, *Economic Annals-XXI*, 169(1-2): 12-14.

Lorincová, S. 2018. Human resource and corporate culture: Gender-based differences in the assessment, *Central European Journal of Labour Law and Personnel Management*, 1(1): 28 – 45.

Machkova, H.; & Sato, A. 2017. Analysis of Competitiveness of Belgian Sugar Industry, *Listy Cukrovarnicke a Reparske*, 133(12): 390-392.

Malec, L.; & Abraham, J. 2016. Determinants of tourism industry in selected European countries: a smooth partial least squares approach, *Economic Research-Ekonomska Istrazivanja*, 29(1): 66-84. <http://doi.org/10.1080/1331677X.2016.1156554>

Mészáros, M. 2018. Employing” of self-employed persons, *Central European Journal of Labour Law and Personnel Management*, 1(1): 46-67.

Miklosik, A.; & Kuchta, M.; & Zak, S. 2018. Monetising Content through Delivery of Advertisements: The Case of Ad Blockers, *AD ALTA-Journal of Interdisciplinary Research*, 8(1): 175-179.

Mura, L.; & Daňová, M.; & Vavrek, R.; & Dúbravská, M. 2017. Economic freedom – classification of its level and impact on the economic security, *AD ALTA-Journal of Interdisciplinary Research*, 7(2): 154 – 157.

Mura, L.; & Marchevska, M.; & Dubravská, M. 2018. Slovak Retail Business Across Panel Regression Model, *Marketing and Management of Innovations*, 4: 203-211.

Mura, L.; & Rózsa, Z. 2013. The impact of networking on the innovation performance of SMEs. *7th International Days of Statistics and Economics*, 2013, 1036-1042.



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Newlands, D. 2003. Competition and cooperation in industrial clusters: the implications for public policy. *European Planning Studies*, 11(5); 521-532.

Obadi, S. M.; & Korcek, M. 2016. The "Revealed" Comparative Advantage and Competitiveness of the EU's International Trade visa vis the USA, *Ekonomicky Casopis*, 64(5); 397-422.

Okanazu, O. O. 2018. Financial management decision practices for ensuring business solvency by small and medium scale enterprises, *Acta Oeconomica Universitatis Selye*, 7(2); 109-121.

Rosas, J.; Macedo, P.; Tenera, A.; Abreu, A.; & Urze, P. 2015. Risk assessment in open innovation networks, *Working Conference on Virtual Enterprises*, Springer, Cham, 27-38.

Sejkora, J. 2014. Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty, *Ekonomicky Casopis*, 62(4); 431-435.

Sejkora, J.; & Sankot, O. 2017. Comparative advantage, economic structure and growth: The case of Senegal, *South African Journal of Economic and Management Sciences*, 20(1), Article Number: a1685. <http://doi.org/10.4102/sajems.v20i1.1685>

Stasiak-Betlejewska, R. 2015. Clusters as the element of eco-innovations promoting in the European construction on the Polish example, *Acta Oeconomica Universitatis Selye*, 4(2): 182-197.

Taušer, J.; Arltová, M.; & Žamborský, P. 2015. Czech exports and german GDP: A closer look, *Prague Economic Papers*, 24(1): 17-37.

Taušer, J.; & Čajka, R. 2014. Hedging techniques in commodity risk management, *Agricultural Economics (Czech Republic)*, 60(4): 174-182.

Tvaronavičienė, M. 2014. If industrial sector development is sustainable: Lithuania compared to the EU. *Journal of entrepreneurship and sustainability*, (1), 3.

Varadin, F. 2016. Global Public Goods and Integration. *Proceedings of the 3rd International Conference on European Integration 2016 (ICEI 2016)*, 2016, 1052-1059

Vojtovic, S. 2016 The Impact of the Structural Funds on Competitiveness of Small and Medium-Sized Enterprises, *Journal of Competitiveness*, 8(4): 30-45. <http://doi.org/10.7441/joc.2016.04.02>

Vojtovic, S.; Navickas, V., & Gruzauskas, V. 2016. Sustainable Business Development Process: The Case of the Food and Beverage Industry, *Advancing Research in Entrepreneurship in the Global Context*, 2016, 1077-1089

Wang, L.; Luo, F. 2011. The Study of the Risk Decision of Cluster Park Engineering, *Systems Engineering Procedia*, 1, 221-227

Zadrzilova, D. 2016. Current Trends in German Sugar Industry, *Listy Cukrovarnicke a Reparske*, 132(12): 390-393.

Zak, S. 2012. International Marketing: Theory, Practices and New Trends. *Prague Economic Papers*, 21(2): 251-254.

Zemanova, S.; & Drulakova, R. 2016. Making Global Goals Local Business in V4 Countries: V4 Entrepreneurs and the UN Global Compact, *Globalization and its Socio-Economic Consequences, 16th International Scientific Conference Proceedings*, PTS I-V, 2490-2497.

Žuřová, J.; Švec, M.; & Madleňák, A. 2018. Personality aspects of the employee and their exploration from the GDPR perspective, *Central European Journal of Labour Law and Personnel Management*, 1(1): 68 – 77.

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## ENTREPRENEURSHIP IN PALM FRONDS RECYCLING: A JORDANIAN CASE\*

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**Abstract.** This research paper argues that date palm fronds are feasible for recycling in bitmus production (organic agricultural soil) and have a good potential as an organic fertilizer. Entrepreneurial projects urge manufacturers to reconsider the use of these wastes of raw materials, and try to preserve them for organic agricultural soil and organic fertilizers' liquid to be used for various plants and trees. This could help in preserving the environment and reducing the consumption of natural resources. The project aims to benefit from the wastes of palm trees in Al Ghor, Jordan, mainly date palm fronds which are abundant (They are presently burned, causing pollution and harm for farmers as well as the soil, the environment and the local community). Such fronds are transformed into useful forage for nutrient animals, livestock and soil fertilizers. The products from this project will be of high value for farmers and can be available as an alternative for imported fertilizers at preferable costs. In addition the produce will contribute in overcoming the shortage of forage materials in Jordan.

**Keywords:** recycling; palm fronds (*Phoenix dactylifera*); bitmus, organic fertilizer; Jordan; entrepreneurship; sustainability

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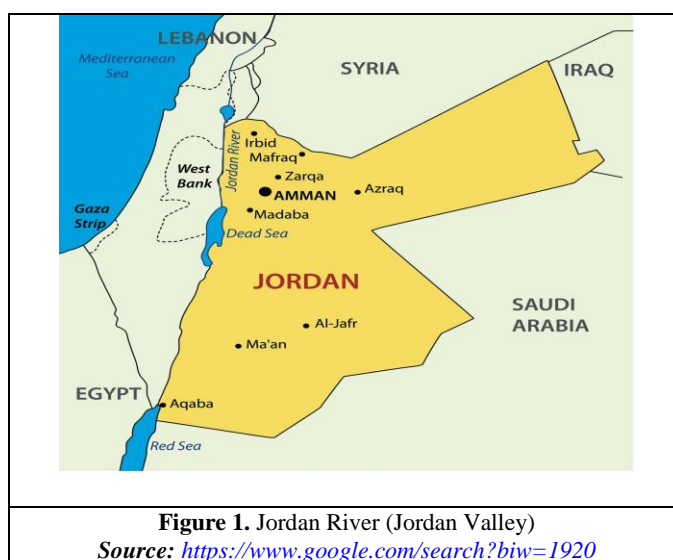
### 1. Introduction

Jordan is a small developing country in the Middle East with a limited natural resources, with the population size estimated to (10,093,380) million and (18.6%) unemployment rate for Jordanian's (DOS, 2018). Jordan is striving for its social and economic survival due to its location in an unstable region, with a total area of (89,342) sq. km

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(of which 99% is land and 1% is water) (Al-Yaseen and Al-Jaghoub, 2012). The Jordan Valley called (Ghor Al-Urdon or Al-Ghawr) forms the west part of Jordan and it applies to the lower course of the Jordan River (See Figure 1).

Ghor Al-Urdon is a long and very narrow; it is 105 km long and when reach Dead Sea becomes 20 km wide; it is the deepest and lowest valley in the world (-212 to -400 m) below sea level; Ghor Al-Urdon is several degrees warmer than other adjacent areas, fertile soils and water made it supportive for palm tree (in 2018 it reached 600,000 trees) (DOS, 2018). Palm trees need to be cleaned twice annually by removing dry fronds, farmers have to process and remove dry fronds throughout burning it. This process of burying dry fronds affect heavily the environment in Jordan and Ghor Al-Urdon in particular. This research attempts to investigate the process of avoiding this way in dry fronds disposal through recycling and waste management to minimize the waste and improve the climate and environment.



The purpose of of Recycling and waste management are to minimize and recycle the waste, recover energy and finally dispose the waste. For example, these principles apply to agricultural industrial wastes such as date palm fronds and palm oil residues as they do to municipal waste. Also, the utilization of renewable energy resources is strategically viable as it can contribute to the sustainability of energy supply while minimizing the negative impacts of energy generation on the environment. The efficient use of oil palm biomass other than the palm oil itself for food consumption is a promising method to obtain more energy from oil palm plantations (Abdullah and Sulaiman, 2013). For grinded date palm trees much applications, it was confirmed that they can provide additional benefits of decreasing water evaporation from the soil surface, helping control weed invasion, dust suppression, helping prevent soil erosion loss by wind or water, providing thermal stabilization by keeping soil cooler in hot weather and warmer in cool weather (Ashworth and Harrison, 1983). But for the purpose of successful recycling we propose these two projects as feasible for recycling in Bitmus production (organic agricultural soil) and a good potential as organic fertilizer.

This research paper is structured as follows: it starts by an introduction about Jordan and mainly Ghor Al-Urdon, and the purpose of this research (environmental problem) when dry fronds disposal, also it includes the main processes which are recycling, waste management, recycled products extracted from palm fronds in Jordan. The second section is relevant literature about palm trees, fronds, fertilizers. The third section is an attempt to develop a theoretical framework to be followed when applying the process of dry fronds disposal. Then the two proposed

projects from dry fronds disposal were explored. The main challenges facing similar ventures in the future were highlighted. We conclude by specifying our contributions to the research and practice of entrepreneurship in the industry of recycling, ending up with the summary and recommendations.

## 2. Palm trees in Jordan

Sulaiman et al., 2015, in their feasibility study of gasification of oil palm fronds, found that oil palm fronds are feasible for gasification and have a good potential as a renewable energy source. (El-deeb, 2017) attempted in her study to find methods to link these materials with Egyptian handicrafts using new treatments in manufacturing with the cradle to cradle idea to produce compressed panels, wallpapers and other objects used in interior design. She asserted that 90% of palm fronds are burned every year in Egypt. This causes environmental pollution and is a waste of sustainable construction materials that include highly recyclable contents, rapidly renewable and biodegradable products, and local resources. A similar study indicated that oil palm fronds are feasible for gasification and have a good potential as a renewable energy source (Sulaiman et al., 2015).

Sadik et al., 2012, tried to produce high quality organic fertilizer at a large scale using abundant energy resources (Date palm trees mulch produced from grinded leaves, trunks and roots) from local farms. Date palm trees mulch (DPM) was mixed with fresh farmyard manure (FYM) as nitrogen source. The results confirmed that complete date palms trees could be recycled biologically into organic product that has the criteria of organic fertilizers, soil stabilizers and soil plantation. Also it was confirmed that the application of a mixture of manure and bio solids is considered the best practice that is commonly used by farmers (Rigane and Medhioub, 2011). Compared to individual fertilizers (such as nitrogen, phosphorus, and potassium), animal manures contribute significantly to soil fertilization. Also, sustained use of manures can improve organic substance and the structure of soils (Benabderrahim et al., 2018).

Nordin et al., 2017, showed that despite of being a biomass waste, oil palm fronds could be used as a starting material for the production of bio-composites for high performance applications. The substitution of natural fibers to petroleum-based materials would reduce the dependency on imported oil, thus contributing to cost-effectiveness. At the same direction, another study was conducted for date palm fronds showed that boards made of date palm pruning residue fibers have better properties than the MDF (Medium Density Fiberboard) property requirements which was recommended by ASTM and EN standards particularly inspecting mechanical properties. In addition, the formaldehyde (HCHO) emission of the panels showed that almost all the boards met the minimum requirement according to EN 120 especially for the panel bonded with MUF resin. Therefore, Date palm could be an alternative material for the manufacturing of MDF (Hosseinkhani et al., 2015).

This study is considered one of the rare studies in the Arab world, especially that most of the foreign studies are concerned with the recycling of palm oil, which is abundant in Asia and Africa with little emphasis on date palm fronds. Considering the large and consistent supply, date palm fronds could be a promising source of organic fertilizer and bitmus production (Organic Agricultural Soil). In the present project, technical feasibility of date palm fronds is studied experimentally via standard tests in the Jordanian (National Center for Agricultural Research and Extension, Directorate of Laboratories and Quality Control) for the proposed organic fertilizer liquid and also in the (Feed Analysis Laboratory) to determine the basic characteristics of a sample of date palm feed. Inclusive analysis is conducted to determine the analyzed results and compare them with some related studies. With the present global concerns of the escalating prices and depleting sources, we hope this study will also add value to existing awareness on entrepreneurship in Jordan. Environment friendly materials need to be carefully selected and applied on the proposed design to “satisfy the current needs without compromising the ability of future generations to meet their needs” (Brundtland, 2013).

These projects seek to build local capacity to identify and implement environmentally robust technologies for waste date palm fronds recycling and to assess their potential for generating new agricultural products, thereby reducing farmers' production costs. It also, assesses the feasibility of these technologies with respect to local socio-economic and environmental characteristics and demonstrates the benefits of selected through entrepreneurial projects.

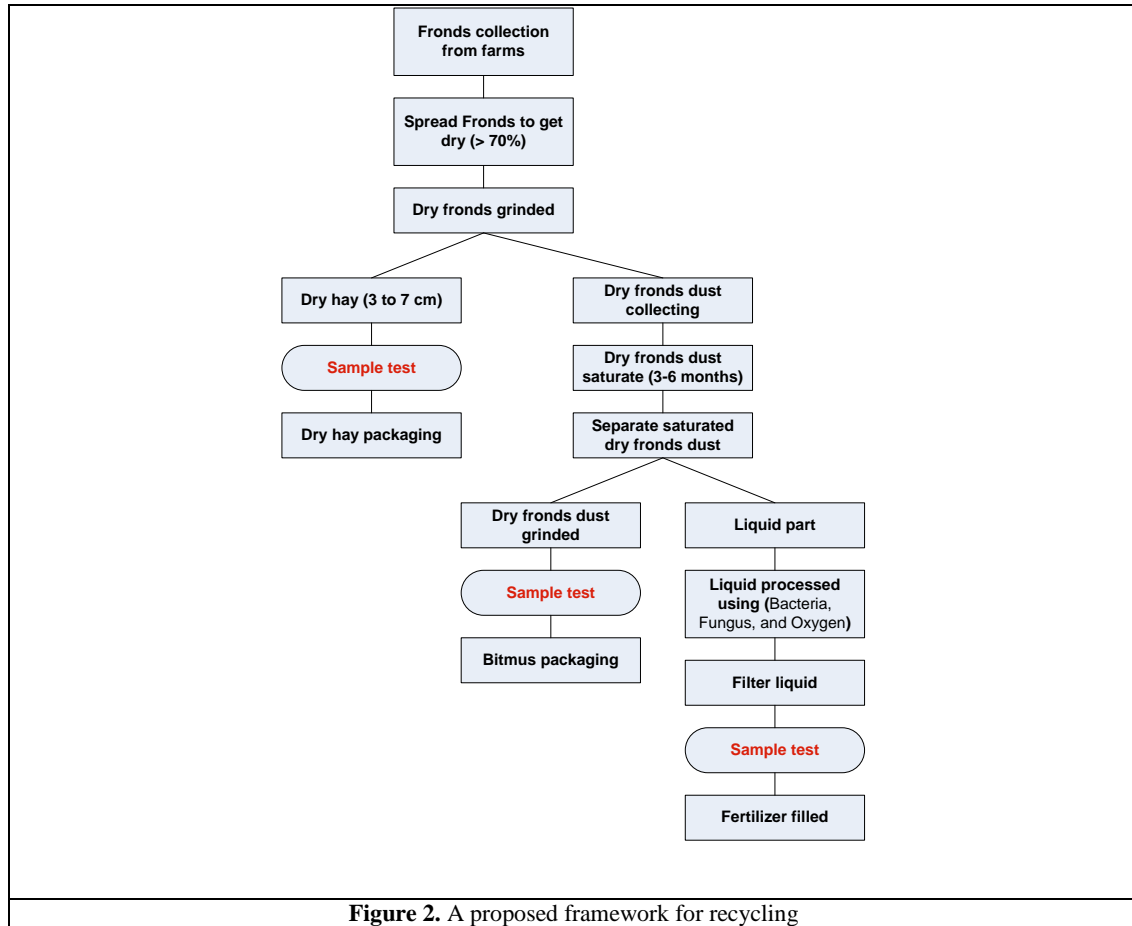
### **3. Research methodology**

For years, date palm fronds are pruned regularly but have little use and are mainly left on the ground in a huge quantity between palm trees to naturally decompose for soil conservation, erosion control and nutrient recycling. Farmers are required to dispose them properly in order to avoid mobilization problems within plantations (Sulaiman et al., 2015). On the other hand, excessive utilization of chemical fertilizers causes the deterioration of qualitative soil and agricultural production (Diacono and Montemurro, 2010; Singh et al., 2007).

Research and studies confirmed that the usage of organic fertilizers is increasing all over world (Agrawal, 2012), and only organic farming can restore the natural fertility of the damaged soil by increasing its soil organic substance which will improve crops productivity to feed the growing population. The same applies to the date palms which grow naturally between 15 to 40 degrees north latitude in the Sahara, and in the southern frontier of the Near East. The date palm is found throughout the Middle East, and in the northern, eastern, and southern areas of Africa.

#### **3.1 Proposed framework of Palm Trees Recycling**

As mentioned before, palm trees have to be cleaned twice a year from dry fronds. The steps of recycling are as follows (see Figure 2): Step one: fronds are collected from the farms and spread it in order to get dry; fronds have to be more than 70% dry; dry fronds are collected again to be grinded into smaller pieces called dry hay (3 to 7 cm length) as required using a modified special machines called (Garouche) for this purpose; it is noticeable that for each (1000 kg) grinded we get (800 kg) dry hay and around (180 to 200 kgs) dry fronds dust, Step two: what left from grinded dry fronds (dry fronds dust) is then saturate into a large holes for a period of time (3 to 6 months) based on the tempreture which is between 20 to 45 degree; through this period of time the content is flipped continuously; after that, we seprate the content into two parts (dry fronds dust and liquid part); the first part which is dry fronds dust then grinded again smoothly and it becomes (Bitmus); the second part (liquid) is processed using special type of Bacteria and Fungus (Figure 2).



#### 4. Palm Trees: The Two Jordanian Entrepreneurship projects

We believe that there is an interesting project in recycling through producing two types of agricultural projects from date palm fronds: Bitmus (Organic Agricultural Soil) and organic fertilizer which could help in preserving the environment and reducing the consumption of natural resources. In Jordan, many difficulties are related to fertilization by cow manure such as handling, transportation and large amounts required to get the nutrient needs of plants. Therefore, the farmers and researchers are continuously looking for an alternative organic fertilizer from their natural ecosystem. Nonetheless, there are rare studies conducted at the present time on dealing with the impacts of these projects. So, this study is conducted taking into consideration that the Jordanian economy is facing many problems; two of the most imperious is the consistently high unemployment rates and lack of natural resources which these projects can contribute in solving these problems. The performance of the projects ensures the economic soundness of the country and act like a protective shield to economic shocks, especially in the developing countries where such types of research are limited.



#### 4.1 Bitmus Project: Organic Agricultural Soil

Bitmus or organic agricultural soil composed mostly of plant material; here in this project, Bitmus is composed from dry fronds dust, Bitmus is essential for plant growth. Conversion of plant waste into organic agricultural soil, which can be useful for agriculture of all types as an alternative to imported Bitmus. The project is unique and innovative, hoping to be the first of its kind in the Arab world.

*Mechanism of the project implementation:*

- 1- Collection of plant waste that is a burden on the environment where it becomes a disgusting health.
- 2- Grind those wastes and cut them into small pieces to speed up the organic transformation process.
- 3- Collecting the milled waste in water ponds and adding microorganisms (bacteria and Fungi) to accelerate the process of decomposition of the original materials for 3-6 months according to the temperature.
- 4- Drying the subsequent solids, then softening them and packing them in bags or containers.

#### 4.2 Organic Fertilizer Project

Organic Fertilizer is a plant fertilizer that is derived from dry fronds dust. Take extracts of the Bitmus dipped from the holes and assemble them into a container for transformation, so that it produces organic fertilizer, liquid and natural nutrient that can be used for all types of plants and trees.

*Mechanism of the project implementation:*

- 1- Extracting Bitmus through dewatering by pumps.
- 2- Collecting liquid extracted in special containers.
- 3- Adding beneficial microorganisms to make the chemical transformations needed to produce the main nutrients of plants naturally away from chemicals.
- 4- Feeding microorganisms with natural nutrients to accelerate decomposition.
- 5- Filtering the extract and pack the products into special containers to be ready for utilization.

#### 5. Bitmus and Organic Fertilizer: Results and Tests

A sample of Bitmus has been sent to the lab (*National Center for Agricultural Research and Extension, Directorate of Laboratories and Quality Control, Feed Analysis Laboratory, Jordan*) for test the contents, results of the test showed that the sample includes material such as: protein (7.25%); fiber (34.29%); moisture (11.04%); ash (14.03%), NDF (60.23%); ADF (40.23%); fat (2.78%); and carbohydrate (51%). The second test was for the organic fertilizer liquid, and the result of the test is presented in Table 1.

Table 1. Organic Fertilizer Liquid tests				
Sample of organic fertilizer liquid				
Laboratory number: 468/2018			Operation number: F/18/173	
Test No.	Test name	Result	Unit	Test method No.
1	pH	7.3		973.04
2	EC	25.5	dS/m	973.04
3	Organic matter	0.8	wt/v %	
4	Organic Carbon	0.5	wt/v %	
5	Fe	128.5	ppm	AOAC 965.09
6	Mg	2581.5	ppm	AOAC 965.09
7	K	1342.5	ppm	AOAC 983.02
8	Na	0.08	wt/v %	AOAC 983.02
9	Cl	0.02	wt/v %	AOAC 928.02
10	Density	1.0	gm/cm <sup>3</sup>	QC-01-016

Most studies were conducted on the same issue recently, but our project started earlier and is considered a unique project because we convert the palm waste into fodder for ruminant animals such as cows, cattle, sheep, and camels etc., as hay and fodder. Most of the previous studies and projects focused on one aim either to produce hay, or to produce compost only. However, this project deals with the two functions, producing forage and producing bitmus and at the same time producing organic fertilizer. There was no similar project that produces bitmus. Even similar projects produce compost by simple and traditional ways, and production of bitmus needs more materials and certain measures that cannot be applied easily. In producing bitmus, we imitate the same method of bitmus production in North Europe and North America.

The proposed project produces three products at the same time from grinding palm waste to producing hay. The waste of producing hay has been used to produce bitmus, and after bitmus preparation we have the liquid which results from bitmus to produce organic fertilizer with high standard quality. Our fertilizer consists of three components including biological organisms, organic abstract and the mineral component. This is why our project produces a unique fertilizer that collects three elements in one product (bio, organic and mineral) at the same time.

The proposed fertilizer acts as three in one (organic, biological, and mineral fertilizer), since this product is unique for its divergence and stimulant moss up grading shape of compost that is rich with organic matter, organic fertilizer and easy to use for seed plantation but compost that does not act as bitmus.

Moreover, the liquid organic fertilizer is saturated with beneficial bacterial (bacillus type) that helps to enrich the plant root environment with soluble fertilizer and upgrade the fertilizer absorption by plants which is reflected on plant production and its size. This advantage is not found in other organic fertilizers, as our fertilizer acts as nutrition for plants and conditioner for soil; which decreases soil salinity, and its PH. It also acts as a challenging factor for mineral fertilizer, keep it in the root and releases it slowly as the according to the plant needs.

## **6. Challenges facing the Projects**

It is reported that in various countries up to 40% of new emerging firms fail within the first 2 years of life (Vivarelli, 2013). There are various factors and challenges which are associated with the low performance of small firm in the developing countries that face unfavorable economic situation, lack of appropriate government policies, poor infra-structural facilities, higher operating costs, corruption (Abdullahi & Sulaiman, 2015; Hafeez et al., 2013), low level of capabilities, insufficient entrepreneurial competencies, difficulty in accessing technology and low productivity (Hussain et al., 2015) and mostly inappropriate and inefficient utilization of the firm resources (Rauch & Hatak, 2016; Bloodgood, 2014; Hilkevics and Semakina, 2019). For the case of entrepreneurial projects, the lack of understanding how small and medium firms can develop essential capabilities and secure their future performance is considered among the challenges that deter success (Greer et al., 2016). However, insights from the United States show a positive indicator where about 50% of all new establishments get through five years or more and about one-third are still operating and running their business after 10 years (SBA, 2014).

We believe that successful entrepreneurs are often described as tenacious, passionate, flexible, and natural risk-takers. They are visionary thinkers, confident, and tolerate ambiguity. Even if an entrepreneur possesses all of these character qualities, a successful business venture requires a viable business concept and a realistic plan. Technically, most of the raw material cannot be readily assessed because major plantation companies are quite reluctant to bring biomass materials beyond their plantation borders. This general logistical issue of transporting the product to the processing points is costly and could be even higher than the cost of the raw material itself.

## 7. Recommendations

The Jordanian government should exert more effort to review and develop related policy and programmers to support the expansion of alternative agricultural resources and feedstock sources for sustainable development of power generation in the country.

Further experimentation with other variable factors will be conducted to confirm our findings with date palm frond fertilizer and bitmus to allow comparisons with similar studies. Date palm waste may create problems of supply because, though they are produced in large quantities, they are quite dispersed and transport costs for this bulky raw material may become more or less an obstacle, so further studies are recommended to make more economic surveys. Additionally, full production trials must be conducted to confirm our pilot-scale results. Moreover, we believe that there are grounds for further investigation regarding entrepreneurial projects from other waste products in Jordan.

## References:

- Abdullah, N., Sulaiman, F. (2013). The Oil Palm Wastes in Malaysia. Chapter 3 in Biomass Now, Sustainable Growth and Use, *edited by Miodrag Darko Matovic*. IntecOpen. <http://dx.doi.org/10.5772/55302>, visited on Jan. 3/
- Abdullahi, I.I., Sulaiman, C. (2015). The Determinants of Small and Medium-sized Enterprises Performance in Nigeria. *Advances in Economics and Business*, 3(5), 184-189. <http://dx.doi.org/10.13189/aeb.2015.030504>
- Agrawal, M. (2012). Book Foreword: Organic Fertilizers: Types, Production and Environmental Impact. Eds. Singh, R. Nova Science Publishers, Inc. New York.
- Al-Yaseen, H. and Al-Jaghoub, S. (2012). Success and Failure of e-Learning Projects: Alignment of Vision and Reality, Change and Culture, *Journal of Emerging Trends in Computing*, 3(2), 277-284. <https://www.ammanu.edu.jo/English/pdf/StaffResearch/IT/749/Success%20and%20Failure%20of%20e-Learning%20Projects%20Alignment%20of%20Vision%20and%20Reality.%20Change%20and%20Culture.pdf>
- Benabderrahim, M. Elfalleh, W. Belayadi, H. and Mansoor, H. (2018). Effect of Date Palm Waste Composts on Forage Alfalfa Growth, yield, seed yield and Minerals uptake. *International Journal of Recycling of Organic Waste in Agriculture*, 7:1-9. <https://doi.org/10.1007/s40093-017-0182-6>
- Bloodgood, J. (2014). Enhancing the Resource-based View of the firm: Increasing the Role of Awareness. *Strategic Management Review*, 8(1), 61-75.
- Brundtland, G. (2013). La Trobe University Sustainability Plan 2013-2017. <https://www.latrobe.edu.au/sustainability> , visited on Dec. 16/ 2018.
- Department Of Statistics (2018) <http://dosweb.dos.gov.jo/>. Accessed December, 2018.
- Diacono, M., Montemurro, F. (2010) Long-term Effects of Organic Amendments on Soil Fertility: a review. *Agron Sustain Dev*. 30(2), 401-422. <http://doi.org/10.1051/agro/2009040> (visited on 30 Dec. 2018).
- El-deeb, A. (2017). Recycling Agricultural Waste as a Part of Interior Design and Architectural History in Egypt. *International Journal on: The Academic Research Community Publication*, 1(1) <http://doi.org/10.21625/archive.v1i1.116>
- Frederick, H., O'Connor, A., Kuratko, D. (2019). Entrepreneurship: Theory/ Process/ Practice. 5th Asia- Pacific Edition. Cen gage Learning Australia Pty Limited.

- Greer, C.R., Carr, J.C., Hipp, L. (2016). Strategic Staffing and Small-firm Performance. *Human Resource Management*, 55(4), 741-764. <http://dx.doi.org/10.1002/hrm.21693>
- Hafeez, M. Shariff, M., Bin Mad Lazim, H. (2013). Does Innovation and Relational Learning Influence SME Performance? Empirical Evidence from Pakistan. *Asian Social Science*, 9(15), 204. <http://dx.doi.org/10.5539/ass.v9n15p204>
- Hilkevics, S.; Semakina, V. (2019). The Classification and Comparison of Business Ratios Analysis Methods. *Insights into Regional Development*, 1(1), 47-56. [http://doi.org/10.9770/IRD.2019.1.1\(4\)](http://doi.org/10.9770/IRD.2019.1.1(4))
- Hosseinkhani, H., Euring, M. and Kharazipour2, A. (2015). Utilization of Date Palm (Phoenix dactylifera L.) Pruning Residues as Raw Material for MDF Manufacturing. *Journal of Materials Science Research* 4, 1. <http://dx.doi.org/10.5539/jmsr.v4n1p46>
- Hussain, J., Ismail, K., Akhtar, C.S. (2015). Market Orientation and Organizational Performance: Case of Pakistani SMEs. *Arabian Journal of Business and Management Review* 5:39.
- Nordin, N. Sulaiman, O. Hashim, R., Kassim, M. (2017). Oil Palm Frond Waste for the Production of Cellulose Nanocrystals. *Journal of Physical Science*, 28(2), 115–126. <https://doi.org/10.21315/jps2017.28.2.8>
- Rauch, A., Hatak, I. (2016). A Meta-analysis of Different HR-enhancing Practices and Performance of Small and Medium- sized Firms. *Journal of Business Venturing*, 31(5), 485-504. <https://doi.org/10.1016/j.jbusvent.2016.05.005>
- Rigane, M., Medhioub, K. (2011) Assessment of Properties of Tunisian Agricultural Waste Composts: Application as components in reconstituted anthropic soils and their effects on tomato yield and quality, *Resource Conservation Recycle* 55: 785-792. <https://doi.org/10.1016/j.resconrec.2011.03.012> Visited on 25 Dec. 2018
- Sadik, M. Al Ashhab, A. Zahran, M. and Alsaqan, F. (2012). Composting Mulch of Date Palm Trees through Microbial Activator in Saudi Arabia. *International Journal of Biochemistry and Biotechnology*, 1(5), 156-161. <http://internationalscholarsjournals.org>
- SBA-Small Business Administration. (2014). Frequently asked questions about small business, SBA office of advocacy. <https://www.sba.gov/advocacy/frequently-asked-questions-about-small-business>
- Singh, R. Sharma, R., Tyagi, S. (2007). Pre-harvest Foliar Application of Calcium and Boron Influences Physiological Disorders, Fruit Yield and Quality of Strawberry (Fragaria x ananassa Duch.), *Sci Horti* (Amsterdam) 112: 215–220. <https://doi.org/10.1016/j>
- Sulaiman, S. Balamohan, S., Moni, M., Atnaw, S., Mohamed, A. (2015). Feasibility Study of Gasification of Oil Palm Fronds, *Journal of Mechanical Engineering and Sciences (JMES)*, 9, 1744-1757, December. <https://doi.org/10.15282/jmes.9.2015.20.0168>
- Vivarelli, M. (2013). Is Entrepreneurship Necessarily Good? Micro-economic Evidence from Developed and Developing Countries, *Industrial and Corporate Change*. <https://doi.org/10.1093/icc/dtt005>

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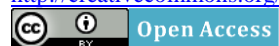
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**STUDY OF INNOVATIVE TECHNOLOGIES IN THE ENERGY INDUSTRY: NONTRADITIONAL  
AND RENEWABLE ENERGY SOURCES\***

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**Abstract.** The goal of the article is to carry out a comprehensive study of theoretical and practical development of innovative technologies in the energy industry through the energy trilemma “energy efficiency – energy security – environmental sustainability”. Transformation of the world energy industry is accompanied by a change in the dominant types of fuel in the energy balance, technological and organizational innovations, expansion and optimization of the supply chain. The current stage of the international energy market transformation is described by a growth of demand for energy supply, intensified use of renewable energy sources, and increase in the energy efficiency. Respectively, the investments in the energy industry should be spent on the creation and implementation of solutions that will meet the growing demand, compensation of the decline in energy supply production from the existing oil and gas fields, and the development of the infrastructure of traditional and renewable energy resources. The article uses the content, analytical, statistical and functional methods of research to explore the current state and trends in the transformation of the global energy industry, the main areas of which are the development of nontraditional hydrocarbon (shale gas and oil sands) and renewable energy sources (RES); the use of these sources on the basis of technological innovation is considered to be more efficient. The following conclusions have been made based on the materials presented in the article: the use of various nonconventional hydrocarbon fields will spread in the energy industry in the coming decades; the specific weight of new technologies applied to production and consumption of energy derived from renewable sources, in particular, will increase; transition from the use of renewable energy sources of the first order to the use of renewable energy of the second order should be expected in the long term; and new energy servicing technologies based on the concept of smart grids will be introduced, along with the development of technologies for the extraction of energy resources.

**Keywords:** innovations; innovative technologies; smart technologies; RES; energy industry; energy resources; energy efficiency; energy security; global economy

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## 1. Introduction

Development of the global energy industry in the period through to 2035 will be primarily focused on meeting the global demand for energy resources for the needs of the growing economy, population and the need to strengthen the fight with climate changes (World Outlook Energy, 2015). Power systems around the world observe dynamic changes, as evidenced by an increase in the share of energy from renewable sources. According to the “2016 global report on the state of the renewable energy sector” (REN21, 2016), the record 147 gigawatts (GW) of renewable energy production facilities were commissioned in 2015. This means that the available capacity of the global renewable energy sector amounted to 1,900 GW. Every year there is a positive development of the sector. The International Energy Agency expects it to grow by another 825 GW by 2021.

Demand for electricity is undergoing significant changes. The developing economies encourage further growth of global power consumption. The annual report “2016 World Energy Outlook” (2015) predicts an increase in power consumption by 48% from 2012 to 2040.

At the same time, it must be noted that 1.2 bln people in the world still do not have access to electricity, as of 2017. Aside from the need to provide energy for all of humanity, digitalization and electrification of new sectors of the economy, in particular transport, are powerful triggers for the development of the modern energy industry. Distributed energy industry and digitalization are important stages in the way towards the abandonment of fossil fuels. A huge leap in the technology development is required to maintain the uninterrupted operation of the decarbonized power system of the future. Many of the innovative solutions have already been developed or are under development.

## 2. Methods

A comprehensive study of trends and problems of the international energy market development is based on the established ideas about the global energy architecture, which is defined as an integrated system of the following components: energy resources (supply); infrastructure; sectors that generate demand for energy resources, which are united by the activities of the government, production and society (The Global Energy Architecture Performance Index Report 2014, 2013). The main goal of the energy architecture is to provide reliable, uninterrupted and environmentally acceptable supplies of energy resources that include the implementation of some tasks forming the so-called energy triangle:

1. achieving the economic growth and development (reliability of the energy industry defines the economic and social development through increasing productivity and facilitating generation of profits);
2. sustainable development of the environment (since energy production, processing and consumption are associated with a significant negative impact on the environment, the key priority of the energy architecture is to minimize it); and
3. promoting access to energy and achieving energy security (shared access to energy is an important component of strengthening the social and economic development; the energy supply chain is described by some risks and disruptions that often arise due to inconsistencies among the market participants) (The Global Energy Architecture Performance Index Report 2014, 2013).

The study of the energy transition determinants involves the systematization of the main factors (formation of energy supply and demand, energy efficiency) that have impact on optimization, quality production and energy



mix in a single market system. The transformation of the energy system is regarded as a long process involving the improvement and expansion of the energy supply chain, where the efficient implementation of its stages – upstream, midstream and downstream – ensures a reliable and uninterrupted supply of the energy resource from the producer to the end user.

### 3. Results

Four global scenarios for the energy development are presented in the world economic outlooks of the International Energy Agency (WEO-2013, WEO-2014, WEO-2015): the Current Policies Scenario, the New Policies Scenario, 450 Scenario, and the Efficient World Scenario, which are presented in Table 1. It must also be noted that a steady increase in energy demand in the emerging markets (India, Malaysia, Indonesia, China, Thailand, Mexico, Brazil, South Africa, etc.) in recent decades has led to an increase in their role as producers of energy products.

**Table 1.** Global scenarios for the energy development (BP Statistical Review of World Energy, 2016).

Scenario	Areas of development
Current Policies Scenario	continuation of the existing energy policy, where the energy development programs adopted by mid-2012 remain unchanged; the goal is to secure basic indicators for the development of energy markets that maintain the current trends in demand for energy consumption
New Policies Scenario	implementation of measures under the energy saving policy; the goal is to ensure balanced energy development in the context of the relevant climate policy
450 Scenario	implementation of the energy saving and energy efficiency policies, increase in the share of renewable energy sources that ensure the total content of CO <sub>2</sub> within 450 PPM (parts per million) in the energy balance; this is a level of greenhouse gases in the air at which the increase in its temperature by the end of the century will not exceed two degrees if the provisions of the Paris Environmental Agreement 2015 are implemented.
Efficient World Scenario	encouragement of the investment policy aimed at eliminating barriers that hamper energy efficiency; the goal is to evaluate the results of energy efficiency to justify the economic benefits

This confirms another area of geographic diversification of the global energy market, which leads to a decrease in the level of territorial concentration of energy resources production with powerful impact on their world trade. It is suggested that the regional energy balance (production less consumption for each region) will substantially change by 2035. For example, it is expected that North America will turn from a net importer of energy into a net exporter in the period from 2018 to 2020; Asia's needs for energy imports will expand (Asia will consume 70% of interregional net imports by 2035). Russia and the countries of the Middle East will remain the largest regional net energy exporters among the export regions, but the share of the latter will decrease from 46% in 2012 to 38% in 2035 (BP Energy Outlook 2030, 2012).

Innovative technologies in the energy industry can be considered from different points of view (for example, in terms of the type of energy produced or the sources of energy used) and can be divided into two broad categories: energy saving technologies (energy saving building materials, energy saving lamps, intelligent metering systems, etc.) and energy producing technologies (efficient boilers, solar collectors, biofuel equipment, etc.). According to the study results, consumption volume of renewable energy sources (RES) was the fastest growing from 2001 to 2014 – 5-fold over the past 13 years, but the share of RES is the smallest in the structure of world consumption (see Figures 1-2).

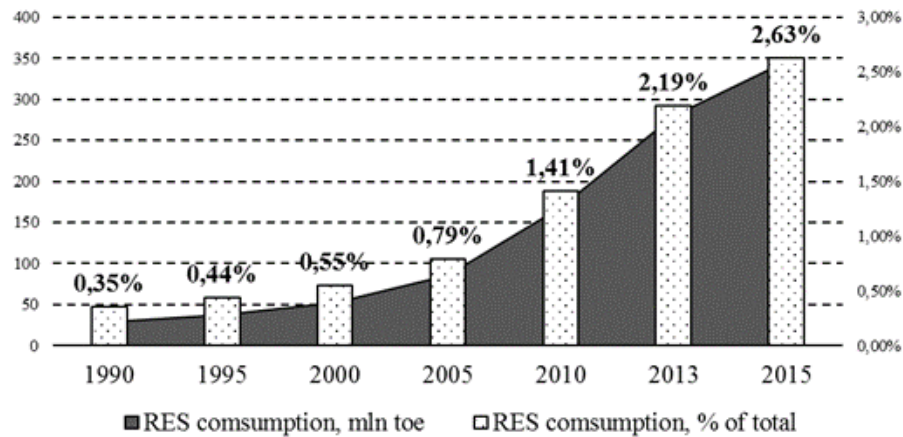


Fig. 1. Dynamics of global consumption of RES (BP Statistical Review of World Energy, 2016)

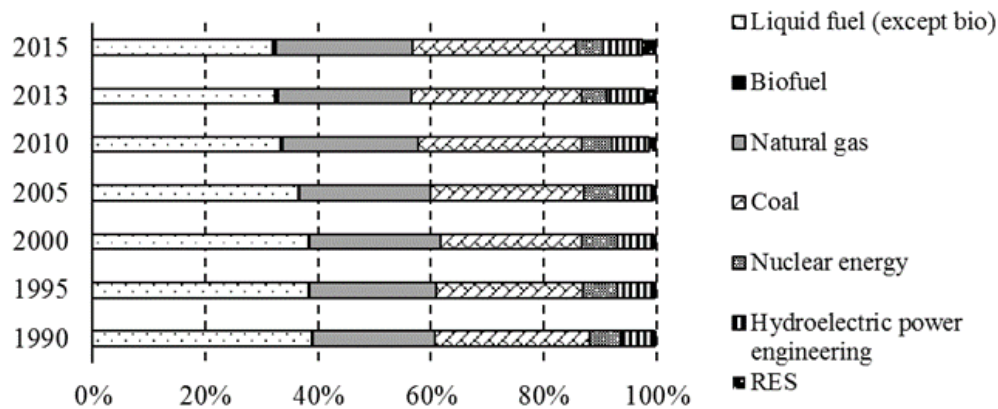


Fig. 2. Structure of global consumption of energy sources, % (BP Statistical Review of World Energy, 2016)

Table 2 contains a description of the expected medium-term trend in the development of renewable energy in the global market.

**Table 2.** Role and trends of technological development of renewable energy sources in the global energy industry (The Global Energy Architecture Performance Index Report 2014, 2013)

Sources	Description
Energy sources of the first order	renewable energy sources (water energy, biomass, solar, thermal and light energy, wind energy, tidal energy, geothermal energy), renewable energy sources, intermediate energy sources, as well as bitumen, high-viscosity oil and oil shale
Energy sources of the second order	sources (and ways of obtaining and storing) of energy, which can be used due to the current level of equipment development, but will require the development of appropriate infrastructure for their production, storage and consumption, which may demand several decades and significant investments. They may include hydrogen, gas hydrates, and plasma technologies
Energy sources of the third order	sources (and methods of obtaining) of energy that have only a theoretical justification for use today, since the use of such energy sources is impossible in the next few decades without achieving an appropriate level of science, technology and engineering development. This category includes the reaction of thermonuclear fusion (using lithium and deuterium dissolved in seawater), delivery of helium-3 to the Earth from the Moon for the thermonuclear power, launch of energy complexes for electricity production (using solar energy) to the geostationary orbit of the Earth with its subsequent transmission to the Earth, illumination of the Earth's surface using space mirrors, gravitational energy industry, and other methods of obtaining energy

Overall, according to the forecast, the transformation of the international energy market by 2035 will be accompanied by its expansion due to the use of different types of energy, including its new forms, which will play an increasingly important role. Renewable energy sources, shale gas and other new sources of fuel will demonstrate a total growth of 6.2% per year and will secure 43% of the increase in energy production by 2035. The development of new types of energy sources will necessitate the development of new innovative technologies and should rely on large-scale investments.

At the moment, the largest part of investments in the amount of about \$1,100 bln per year is allocated to such areas of the international energy market as extraction and transportation of fossil fuels, oil refining, and development of fossil fuel power plants. An analysis of the areas dealing with the receipt of global investments in the energy sector indicates the growing importance of renewable energy sources (the annual investment volume for the development of such resources amounted to \$60 bln in 2000, and to \$300 bln in 2011) (Energy Vision 2013 Energy transitions: Past and Future, 2013). It is expected that in order to meet the global energy needs, the volume of investment will increase to \$2,000 bln by 2035 (for comparison, this figure was \$1,600 bln only 5 years ago, in 2013), while the annual cost of energy efficiency will increase to \$550 bln (against \$130 bln in 2013) (World Energy Investment Outlook, 2014; Strategic transport infrastructure needs to 2030, 2011).

The main components of investment in energy supply by 2035 will be allocated to the following sectors: extraction and transportation of fossil fuels, oil refining (\$23 trln), power plants (\$6 trln for those using renewable sources, and \$1 trln for nuclear power industry), and development of the system for the transfer and distribution of energy resources (\$7 trln). About 60-70% of such investments will be concentrated in energy systems in developing countries and countries with transitive economies: Asia in general and China in particular, Africa and Latin America (World Energy Investment Outlook, 2014). A review of analytical sources reveals that more than half of the investments in energy supply will be allocated to meeting the growing demand, compensating for the decline in energy carriers production from the existing oil and gas fields (80% of investments), replacing and updating power plants that are obsolete both from the infrastructure and technological point of view (60% of investments in the electric power industry of the OECD countries) (World Energy Investment Outlook, 2014; Strategic transport infrastructure needs to 2030, 2011; Ageev, Ovchinnikov, 2016).

Industry and national governments are the main subjects that have significant impact on the development and transformation of the international energy market. On the one hand, the activities of industrial enterprises encourage the development of new ways of safe and reliable energy supply, the introduction of the efficient risk management system, long-term planning, investment and integrated management of systems of energy resources transmission and use. On the other hand, the provisions of political programs are aimed at creation of a flexible approach to the development of competitive investment, innovation and international cooperation of the energy market participants, including through the use of energy diplomacy.

Harmonization, improvement and implementation of fair legislative, tax and regulatory frameworks are supposed to promote support and long-term development of energy based on the mutually beneficial cooperation of market participants (Energy Vision 2013, Energy transitions, 2013). The position of the governments of countries supplying resources to the international energy market is built based on the definition of development priorities and areas of cooperation with other market participants to make energy models contribute to the achievement of economic growth, environmental sustainability and energy security.

#### **4. Discussion**

Given the trends of the world energy architecture development, it can be asserted that the abovementioned market participants intensify their efforts towards the development of nontraditional hydrocarbon (shale gas and oil

sands) and renewable energy sources, the use of which now seems more efficient and acceptable in terms of technological innovation – in particular, for the environment. However, it must be noted that oil and gas will continue to provide about 60% of the world's energy consumption over the next 2 decades. Oil will remain the most common type of fuel, while natural gas consumption will also grow rapidly (the demand for natural gas will increase more than 1.6 times from 2010 to 2040). The use of natural gas as an affordable and efficient means of electricity generation will have positive impact on the environment. The bulk of the production of crude oil and natural gas will continue to be produced from conventional sources, but the specific weight of production of more deep-sea environments and subsoil use in the Arctic will grow (Dudin at al., 2017; Martsinkevich, 2017).

Electric power will be the largest factor of demand in the energy market, which indicates an improvement in living standards, since more consumers and businesses get access to safe and reliable electricity supply. In general, according to the findings published by the International Energy Agency, the electric power industry paves its way to the energy system decarbonization. The main barriers to the implementation of the next stage of the world energy market transformation are the following (Energy Vision 2013 Energy transitions, 2013; Energy infrastructure. Priorities for 2020 and beyond, 2011):

- significant actual demand secured by hydrocarbon energy sources and a high level of development of infrastructure for the transfer of such energy carriers: the structure of energy consumption will not significantly change by 2030;
- innovation and development, pricing and state policy will play an important role in the integration of renewable energy sources into industrial and domestic consumption (it is important to understand the long-term and comprehensive nature of full implementation of such qualitative transformations of the energy market);
- discussion of the expediency of replacing relatively low-cost resources (oil, gas) with wind or solar energy, which is described by high cost and low density of placement;
- biofuels require an additional infrastructure for the transfer of such energy resources.

As such, "... both the introduction of innovations and finding the necessary capital and managerial reserves, ensuring payback prospects and testing ranges for the introduction of versatile innovative solutions become urgent ..." at the present stage for the world energy market (Inshakova at al., 2018).

Energy efficiency plays a key role in limiting the growth of energy consumption. In OECD countries, the implementation of programs to improve energy efficiency will reduce the growth of electricity consumption by 60% from the maximum possible level. Besides, according to WEO 2015, the energy efficiency of new equipment, which will be produced in the world by 2030, can be increased by additional 11%, while an average cost of energy saved will amount to \$300 per ton of oil equivalent (toe) at a weighted average price of \$1,300/toe. The energy consumption of heavy vehicles is now regulated only in the US, Canada, Japan and China; the European Union also has plans to introduce regulation. Expanding geographic coverage and more stringent standards can reduce fuel demand for new cars by 15% by 2030. Changes in product design, reuse and recycling ("material efficiency") will also help increase the energy saving potential. At the same time, about 60% of investment in new power plants will be spent on renewable energy technologies by 2040, and as a result, the global production of electricity from renewable sources will increase by about 8,300 TWh (more than half of the total production growth), which is equivalent to the present total production of all fossil-fuel power stations in China, the US and the EU member states.

The renewable energy sector is a potential source of a large number of new jobs. About 10 mln jobs have been created in the world coal industry by now. Photovoltaics can create the same number of jobs as soon as in 15 years. The wind energy industry can grow from the current 700,000 jobs to 7.8 mln jobs in 2030 (which is twice as much as now in the global oil and gas industry), but the changes are required right now. The number of employees in the coal industry will significantly decrease by 2030. It is expected that the energy sector in the world will account for 30-35 mln jobs in 2020, this figure can grow up to 45 mln jobs in 2025, and the number of

jobs will exceed 46 mln by 2030, with up to 86% of jobs in the energy sector attributed to the renewable energy sector by 2030.

As a result, the share of coal in the global electricity production structure will drop from 41% to 30%, while gas, nuclear and hydropower sectors will maintain their current shares in the global energy balance. The renewable energy production in the energy balance will reach 50% in the EU member states, almost 30% in China and Japan, and over 25% in the US and India by 2040.

The introduction of new smart grid technologies will allow to improve the infrastructure operation, increase energy security, reliability and efficiency of energy supply, and support the development of new energy supply models based on distributed generation and renewable energy sources. Intellectual power networks have huge potential. According to the report of the European Commission “Smart Grid projects in Europe: lessons learned and current developments” published in 2011, the volumes of investment in smart grid projects will amount to:

- about 56.5 bln Euros by 2020 in Europe;
- 238 to 334.5 bln Euros by 2030 in the US; and
- about 71 bln Euros by 2020 in China.

According to the 2012 report of the British company Memoori Research, the volume of investments in the global smart grid market by 2030 will amount to \$2 trln (Memoori: Smart Grid Research, 2012). The global smart grid market can reach \$155 bln in 2018, which is 50% more than the current annual cost of equipment for electricity transmission and distribution. The average annual cost of Smart Grid in the US amounts to \$22 bln, and will reach a peak of \$35 bln in 2021.

The US is currently the world leader in investing in smart grids. Europe funded smart grids through the relevant programs of the European Union, while some demonstration projects were sponsored within the programs of countries participating in them. China adopts investment plans for nationalized energy enterprises with direct or indirect support at the state level. Due to the introduction of smart grids in the EU countries, it is expected that energy supply through smart grids will account for one-fifth of the total energy supply by 2020.

Return on investments in the implementation of Smart Grid programs is high, especially on investments in the smart systems of metering energy consumption. According to estimates of American specialists, the savings may amount to about \$48 bln (including investments) over 20 years of using smart grids. European countries count on annual savings of about 7.5 bln Euros. The introduction of standard smart meters in the commercial or industrial sector in the UK provides return on investment within 10-14 months. According to the study conducted by Navigant Research, the annual global revenue from the introduction of intelligent accounting systems will increase from \$4.4 bln in 2013 to \$6.6 bln in 2023 (Navigant Research, n.d.).

As of 2017, the largest number of smart metering systems are in Europe and the Asia-Pacific region. It is expected that the number of new smart meters introduced in Western Europe will increase to 93 mln units by the end of 2020. 80 mln new smart meters will be installed in Japan by 2020. The installation of intelligent sensors is being tested in India, and forecasts say that the number of smart meters in this country can reach 150 mln by 2020. Grand View Research estimates the volume of the global smart metering market in 2013 at about \$11 bln. According to the forecasts of the research company, the average annual growth rate of the smart metering market in the Asia-Pacific region will amount to 10.4% in the period between 2014 and 2020 (Grand View Research, n.d.). The US, Japan, China, Brazil, India, Britain, France, Germany, Russia, and Mexico will lead by the number of plants generating energy from renewable sources. The aggregate rate of annual growth in these countries is expected at 22%. The total number of smart meters in the world will amount to about 1.1 bln units by 2024, or 57% of the total.



## Conclusion

The observed scientific and technological advances predetermine that further progressive development of the energy industry will be defined by the formation of a new technological order based on scientific developments in biotechnology, genetic engineering, informatics, microelectronics, as well as intensive space exploration and creation of new types of raw materials, resources, and energy. This means that new sources of energy (primarily renewable energy sources) will be widely spread in the long term, and an appropriate infrastructure for their use will be established, which will influence the global consumption of hydrocarbon raw materials. It must be noted that the development of an appropriate infrastructure for the use of new types of energy takes about 25-30 years, since the energy industry is a fairly conservative sector of the economy, while the technological limit of the previously created infrastructure has not yet been achieved.

As such, it can be expected that a trend for a long-term transition to renewable energy will be formed along with the development of nonconventional hydrocarbon deposits (shale gas, oil and oil sands).

Based on the above, the following conclusions about the areas of the innovation-driven growth of the global energy industry can be drawn:

- 1) the demand for traditional hydrocarbon energy carriers will be quite high in the first half of this century, and they will retain the bulk of the global energy balance by 2050;
- 2) there will also be an improvement in the technologies for exploration, extraction, production, and consumption of traditional and nontraditional hydrocarbons, as well as nuclear energy industry, energy saving and energy efficiency, in the first half of the XXIst century;
- 3) renewable energy sources will build up their share in global energy consumption, and the change in the next technological order will lead to an absolute reduction in the consumption of not only oil, coal and gas, but also primary energy in general in many industrialized countries;
- 4) the advances of science and technology will allow to lay the basis for the transition to a new stage in the development of the energy industry in the coming decades – the widespread use of renewable energy of the second order. The appropriate infrastructure will be gradually built. The use of renewable energy sources of the first and second orders will also lead to a drop in global demand for hydrocarbon raw materials;
- 5) with the transition of the world economy to the next technological order, further development of the energy industry will be defined by the use of the alternative energy sources of the second and third order and nuclear energy, while the share of oil, gas and coal will gradually decrease to 50-60% of the total consumption of primary energy resources;
- 6) investments in smart grids have already enabled energy companies to create a whole range of new tools that help improve customer relationships. The service portfolio of energy companies will change accordingly in the process of transformation of customer relationships; and
- 7) the following services will be in demand in the energy industry in the short and medium term: demand management programs; solutions based on distributed electricity generation and saving; energy saving programs, which also provide financial support and technical advice.

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## References

- Ageev, A. I., Ovchinnikov, V. V. 2016. Sistemnyye konstruktzii globalnogo rynka nefti i nefteproduktov [Consistent constructions of the global market for oil and oil products]. *Economic Strategies* 4: 122–133.
- BP Energy Outlook 2030. 2012. British Petroleum, London. [http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/BP\\_World\\_Energy\\_Outlook\\_booklet\\_2035.pdf](http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/BP_World_Energy_Outlook_booklet_2035.pdf)
- BP Statistical Review of World Energy. 2016. <http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2016/BP-statistical-review-of-world-energy-2016-full-report.pdf>
- Dudin, M. N., Frolova, E. E., Sidorenko, V. N., Pogrebinskaya, E. A., Nikishina, I. V. 2017. Energy policy of the European Union: Challenges and possible development paths. *International Journal of Energy Economics and Policy*, 7(3): 294–299.
- Energy Infrastructure. Priorities For 2020 And Beyond – A blueprint for an integrated European energy network. 2011. European Commission, Luxemburg: Publications Office of the European Union, 41.
- Energy Vision. 2013. Energy Transitions: Past and Future. 2013. World Economic Forum, Geneva. [http://www3.weforum.org/docs/WEF\\_EN\\_EnergyVision\\_Report\\_2013.pdf](http://www3.weforum.org/docs/WEF_EN_EnergyVision_Report_2013.pdf)
- Grand View Research. <https://www.glassdoor.com/Reviews/Grand-View-Research-Reviews-E866553.htm>
- Inshakova, A. O., Frolova E. E., Marchukov, I. P. 2018. The general energy policy and ways of development of legal regulation of the foreign trade turnover of energy resources of the Russian Federation and the EU. Energy sector: a systemic analysis of economy, foreign trade and legal regulations, Springer International Publishing AG, 187–206.
- Inshakova, A. O., Frolova, E. E., Marchukov, I. P. 2018. TNCs as subjects of economic activity and lawmaking in the sphere of foreign trade in energy resources. Energy sector: a systemic analysis of economy, foreign trade and legal regulations, Springer International Publishing AG, 151–172.
- Martsinkevich, B. 2017 Arktika – territoriya razvitiya [The Arctic – a territory of development]. Analytical online magazine “Geoenergetika.Ru”. Available online: <http://geoenergetics.ru/2017/10/31/arktika-territoriya-razvitiya/>
- MEMOORI: Smart Grid Research. 2012. <https://www.memoori.com/research/>
- Minasyan, M. V. 2015. Rol neftegazovogo kompleksa v formirovanii innovatsionnoy ekonomiki Rossii [The role of the oil and gas complex in the establishment of the innovative economy of Russia]. *International Scientific and Research Journal*, 7 (38), Part 3: 81–84.
- Navigant Research. <https://www.navigantresearch.com/about-navigant-research>
- Renewables 2016 Global Status Report – REN21. [http://www.ren21.net/wp-content/uploads/2016/06/GSR\\_2016\\_Full\\_Report.pdf](http://www.ren21.net/wp-content/uploads/2016/06/GSR_2016_Full_Report.pdf)
- Smart Grid Projects in Europe: Lessons Learned and Current Developments. 2011. [http://ses.jrc.ec.europa.eu/sites/ses/files/documents/smart\\_grid\\_projects\\_in\\_europe\\_lessons\\_learned\\_and\\_current\\_developments.pdf](http://ses.jrc.ec.europa.eu/sites/ses/files/documents/smart_grid_projects_in_europe_lessons_learned_and_current_developments.pdf)
- Strategic Transport Infrastructure Needs to 2030. 2011. Main findings, OECD Futures Project on Transcontinental Infrastructure Needs to 2030/50/ OECD. Paris. <http://www.oecd.org/futures/infrastructureto2030/49094448.pdf>
- The Global Energy Architecture Performance Index Report 2014. 2013. The World Economic Forum, Geneva. [http://www3.weforum.org/docs/WEF\\_EN\\_NEA\\_Report\\_2014.pdf](http://www3.weforum.org/docs/WEF_EN_NEA_Report_2014.pdf)
- World Energy Investment Outlook. 2014. Special Report, International Energy Agency. Paris, 2014. <http://www.iea.org/publications/freepublications/publication/WEIO2014.pdf>
- World Outlook Energy. 2015. <https://www.iea.org/publications/freepublications/publication/WEO2015.pdf>



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## THE IMPACT OF E-PORTFOLIO USE ON THE DEVELOPMENT OF PROFESSIONAL STANDARDS AND LIFE SKILLS OF STUDENTS: A CASE STUDY

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**Abstract.** Advancements in Information and Communication Technology (ICT) have transcended barriers and have encompassed almost all aspects of life. It has made valuable contribution to the education sector in general and teacher education in particular. E-portfolio is of great utility and indispensable in the education sector. Its use enables teachers with the opportunity to conveniently return to their experiences and provide the required feedback to the examinee. Using a semi-experimental approach the researcher analyzed the content to prepare the evaluation card for the e-portfolios of student teachers in a prominent University in Saudi Arabia. Amon others, it also addressed the question as to what e-portfolio content is required for the development of professional standards. The findings of the study show that the use of e-portfolios improves capabilities, skills, and knowledge. It also encourages student teachers to know about tendencies, trends, and interests by preparing the file and compiling its contents. A few suggestions arrived from the study is also provided.

**Keywords:** E-portfolio; Life skills; Trainig; Princess Noura; Saudi Arabia

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**Additional disciplines:** educology, sociology, psychology

### 1. Introduction

The world has witnessed tremendous development in the field of information and communications technology (ICT) in the preceding and the present century. These developments have transcended barriers and have encompassed almost all aspects of scientific, economic, cultural, and social life; and education sector in general and teacher education in particular is no exception. The use of technologically advanced tools in teacher education programs has become indispensable and justified by the nature and intensity of the overall

developments in the sector. Technological developments have now been clearly imprinted on the education system in general, and on teacher education programs in particular. It can now be considered as a force to be reckoned with as it has the propensity to affect every aspect of the educational process – both positively and negatively (Sulphey, 2017; Qutait, 2009; Tkacova et al., 2018).

E-portfolio, which is becoming increasingly indispensable in the education sector, can be used to a host of uses like documenting teachers' educational performance, encouraging them to think reflectively, and promoting their professional growth. The use of e-portfolios gives teachers the opportunity to return to their experiences and, thus, provide feedback for the examinee. Though e-portfolios contain the same types of information as their traditional counterparts (paper portfolios); they collect, store, and manage this information electronically. The advantage of e-portfolio is that it requires teachers to be critical with respect to document selection. They are expected to do this based on quality rather than quantity. To develop their performance, teachers should adopt contemplative thinking methods that reflect their own views, based on their experiences (Constantine and Lorenzo, 2004). According to Gordon (2009) the use of e-portfolios enables teachers and supervisors to follow up on their students' work; on the basis of predefined criteria that enable the evaluation and feedback of completed reports, assignments, and other activities or materials.

In addition to providing tools for professional empowerment, e-portfolio encourages teachers to assume very high levels of responsibility (Constantine and Lorenzo, 2004). The platform for discussions presented by e-portfolio provides learners with an opportunity to obtain feedback. Since all the records of their performance and development are maintained, it enables teachers to learn and grow as professionals through a form of cooperative mentality. Enrichment of an e-portfolio is possible by including more relevant information related to educational objectives. This information can be presented in various forms, such as animations, simulations, television images, multimedia projects, and presentations. The file attachments can be stored on CD-ROMs, as well as on an electronic index, which helps the evaluator identify the sections in which he or she is most interested. Visually checking and reviewing these sections does not require one to browse through pages (Al-Massaad, 2012).

Professional standards are required to mould future teachers and to make them perform skillfully, quickly, and masterfully. All these skill sets are intertwined, and they contribute towards performance of specific professional activities that could involve planning standards, lesson implementation, teaching aids, classroom management, and assessment (Abu Sawawin, 2010). Several studies have emphasized the importance of preparing students on the basis of professional standards. This can be done through field training programs that serve as a tool of educational experience and prepare students for the teaching profession (Mulla, 2004).

Further, it is indispensable for the students to have the required skills to address the challenges and difficulties they encounter in their lives in accordance with their beliefs and preferences (Aga, 2012; Sulphey and Al Kahtani, 2017). Acquiring of these life skills has to be an important product of the curriculum at all levels of education. This should not be limited to a particular subject, and is the joint responsibility of all teachers that can in no way be exempted from any specialization. Life skill would help students develop social skills and enable them to live and deal appropriately with different people and circumstances (Ayad and Saad al-Din, 2010). Nasr (2011) stresses that students' mastery of life skills creates an opportunity for them to excel in life. She proposed training students in skills and practices by following an evidence-based approach that could enable the identification of actual student needs, as well as the potential pressures and challenges they face. Ayad and Saaduddin (2010) classified life skills into three main categories:

- Basic life skills, including in communication, writing, and reading
- Analytical life skills, including in problem-solving, information research, and technology use
- Effective skills, including in conflict management, citizenship, and career development

Presently e-portfolios are used by numerous universities, colleges, and schools in the United States as a tool for evaluating teaching learning process. Now based on the stipulations of the National Board for Professional Teaching Standards, it has become a key element. The American Association of Higher Education has stipulated that e-portfolios must be used as a tool to improve teaching in colleges and universities. Further, the use of e-portfolios has become one of the conditions for obtaining a license to practice teaching (Qutait, 2009).

Recently Saudi Arabia has been focusing on strategies towards enhancing the quality of higher education (Sulphey and Al-Kahtani, 2018; Sulphey, AlKahtani and Syed, 2018). The Government has been allocating substantial sums towards this too. Princess Noura Bint Abdul Rahman University is a premier Institution in Saudi Arabia with state-of-art facilities. The College of Education at the University is keen to provide students with advanced ICT skills. However, these skills fail to enable them to design and utilize their own e-portfolios. Today, paper portfolios are being used by students due to various reasons. Some of them include low student awareness levels regarding the design, production, and benefits of e-portfolios. This issue made the researcher to examine need of recognizing the association of using e-portfolio for the development of professional standards and life skills among the students. The present study is conducted at the Faculty of Education at Princess Noura Bint Abdul Rahman University, Saudi Arabia.

## **2. Review of literature**

The theoretical framework for this study addresses several issues related to the subject of the research. The literature review begins with a brief background of the transition from paper-based portfolios to e-portfolios, summarizing the incorporation of the latter into higher education as a tool for program evaluation and assessment. It also considers its value in developing the professional standards and life skills of student teachers.

### **e-Portfolios – from Paper to Electronics**

Student-developed portfolios were first introduced in the 1960s. Prior to this portfolio was used by artists and designers to gather and present their work. Portfolios were popular until the early 1990s because of the widespread belief in their effectiveness within the liberal education movement, which made conservative means of authentic evaluation (Fenwick & Parsons, 2009). The National Learning Infrastructure Initiative provided the following definition of an e-portfolio:

A collection of authentic and diverse evidence, drawn from a larger archive representing what a person or organization has learned over time, on which the person or organization has reflected, and that is designed for presentation to one or more audiences for a particular rhetorical purpose. (Barrett, 2007, p. 438)

The use of portfolios for educators is defined as:

“A purposeful collection of student work that exhibits the student’s efforts, progress, and achievements in one or more areas. The collection must include student participation in selecting contents, the criteria for election, the criteria for judging merit, and evidence of student self-reflection.” (Paulson, Paulson, and Meyer, 1991: 60)

According to Barrett (2007) portfolios have several labels like documentary bag, student work file, learning file, achievement file, learning bag, performance file, and growing records. They could be paper contents (documentaries), videos, and audio tapes, as well as pictures from magazines, newspapers, and paper texts. She added that achievement files can take numerous forms like paper portfolios and e-portfolios (CD, Web and Web + CD). In higher education institutions, e-portfolios have become a popular “tool to enhance learning, conduct assessment, meet standards, and increase student employability” (Chatham, et al., 2009: 438).

### The Role of e-Portfolios

Studies by Abrinca (2007) and Barrett (2007) found that the e-portfolio differs from the paper portfolio in numerous ways. It also has a number of advantages. E-portfolios, for example, are able to integrate more than one technological medium like presentations, videos, fixed or mobile images, and/or written text. The following are additional advantages of the e-portfolio:

- Easy storage.
- High storage capacity using minimal space.
- Easy construction and control.
- Minimal time and effort.
- Development of teachers' and students' technological skills.

Chatham, et al. (2009) stated four goals of e-portfolios: to facilitate reflective learning, showcase career skills, showcase professional standards, and assist with program review and assessment.

### Benefits of e-portfolio in field training

The electronic achievement file has a number of benefits (Mazen, 2009), which are now be reviewed.

1. **Enhancement of self-assessment and reflection:** The e-portfolio enhances the development of self-assessment and contemplative thinking (Barton, Collins, Barton, and Collins, 1993). The practical initiation of the e-portfolio requires the teacher to determine facts or educational events, analyze occurrences, and assess students' educational performance and learning outcomes (O'Leary, 2008). E-portfolios can take the form of video and audio recordings. For teachers, this provides a true picture of their performance in the classroom, thereby giving them the opportunity to reflect on and analyze educational experiences and events, which can ultimately promote self-assessment and reflective thinking.
2. **Achievement of personal satisfaction and reflecting innovation:** The e-portfolio is the result of the owner's efforts. It is the purposeful collection of his or her best work during a certain period, and it demonstrates the progress in different areas, thereby giving a sense of satisfaction and self-confidence. It can be considered as a mirror that reflects the personality of the owner, as well as the extent of his or her progress and development (Gartner, 2011).
3. **Provision of tools for professional empowerment:** E-portfolios can be a source of power and empowerment, as they encourage teachers to carry greater responsibilities, which enables them to learn and grow professionally. Additionally, during the course of their service, it helps them to set their goals and their plans for continuous professional growth, as opposed to relying on an administrator to determine the efficiency of their professional development through one or two evaluation processes conducted throughout the year. According to Andreson and DeMuelle (1998), pre-service teachers who use achievement files are more informed about topics related to the difficulties of a profession in education. They are better capable of conducting self-evaluation, and better understand the importance of continuing professional development.

Teaching is not defined solely by number of courses taught; but also by the various and varied experiences, research, workshops, and other educational activities that contribute to teachers' growth. Mentors are responsible for integrating the knowledge, attitudes, and skills that they have learned through these experiences and documenting them in their professional files; thereby giving them considerable power to build their self-confidence as new teachers.

**Achieving scientific cooperation**

The achievement file is a method of evaluating educational performance, and it gives the teacher opportunities to participate in collaborative discussions with the evaluator, through regular feedback and guidance. The collaborative approach to building personal experiences to support self-reflection and improve teaching skills leads to the common goal of sustained professional growth (Gartner, 2011). The use of e-portfolios facilitates Internet file sharing and, therefore, the potential to receive feedback not only through but also beyond the supervisor, such as other external supervisors, peers, mentors, cooperating teachers, and parents.

**Integrated curves in the evaluation of practical training programs**

The completion of an e-portfolio provides evidence of performance through demonstration and the use of multiple sources of information, which is impossible to achieve using traditional evaluation forms. The e-portfolio is, therefore, a more reliable tool for evaluating teachers' learning and growth (Lowendahl, 2011). E-portfolios are important tools, as they add more life and depth to traditional evaluation methods. The items included in an e-portfolio are original study plans; evidence of students' learning through written feedback from classroom observation; and culturally and socially based inputs. These provide a holistic view of the achievement of each individual, compared to relying solely on his or her overall grades, examination results, and curriculum vitae.

**Criticism of e-portfolios**

e-portfolios have been criticized by a number of researchers. It is opined that in theory, e-portfolios were believed to be beneficial for learning. However, in practice, they were noted to cause confusion and disappointment (Chau and Cheng, 2010). Deneen and Shroff (2010) discussed whether the benefits of e-portfolio use outweigh the costs of acquiring the required ICT literacy (time, money, and patience). Their conclusions were positive but included significant cautions regarding technology challenges that may be addressed through time, structure, and diligent effort. According to Al Masad (2012), administrators expressed concerns regarding the potentially excessive amount of time required for the use of e-portfolios as assessment tools. Additionally, Al – Omari (2013) warned that the effective application of e-portfolios required significant awareness of processes and workflows.

**Criteria for success**

Extensive research and numerous case studies have addressed the effective application of e-portfolios. The recommendations are provided in various areas, such as stakeholder administration, faculty and student commitment, program organization, mentoring and practicing, and ICT literacy. Barrett (2007) stated that the teacher's position is critical to success, and high-accomplishing teachers (as judged by student commitment) effectively used reflection, awareness, and other learning strategies to provide students with detailed feedback. Overall, ICT strategies and skills, support systems, and cooperators were also important components of high levels of student commitment. Deneen and Shroff (2010) discussed the importance of ICT literacy and innovative educational programs in effective e-portfolio application.

To improve reflective learning, Winsor, et al (1999) suggested the utilization of a sophisticated model using inquiry as the primary means of guiding the student during the portfolio process, thereby leading to high-quality reflective learning. Tindall-Ford, Waters, and Johnson (2010) explained various requirements, which included thorough planning by staff and students; e-portfolio assignments planned from the basics, as opposed to proceeded as using preset assignments. Certain others include the demand for key stakeholders to accept the standard and function of the e-portfolio system; the use of recommended training and outstanding assistance; an affirmative and supportive culture; and the availability of the e-portfolio to enable the student access after graduation.

Al Masad (2012) stressed the significance of early agreement on the objectives of evaluation and the need to encourage collaboration among administrators, faculty, consultants, and program reviewers. Hallam and Creagh



(2010) pointed out that open discussion and cooperation among stakeholders is crucial. According to Granberg (2010), it is necessary to cope with the stress between using e-portfolios for summative evaluation versus for outstanding reflection and learning. Buckley, Coleman & Khan (2010) stated that an e-portfolio program should allow for the following: rational time requests; assistance with improving one's reflective skills; portfolios preparation that reflects training demands; specific goals and objectives; consistency with regard to course outcomes; and obvious guidelines governing requirements, word count, and time involvement. The program should also be implemented with an extensive amount of time to enable the promotion of reflective skills.

According to Al Masad (2012), there is a predilection for fulfilling e-portfolios using a bottom-up rather than a top-down approach. They also discussed the need for a considerable amount of administrative assistance for faculty and students, organized technical help, and need for the faculty members participating in e-portfolio's need to broaden their vision. Winsor et al. (1999) advised that the program should be designed to guarantee constant access to the e-portfolio and sufficient ICT and process training for both students and faculty.

### **Professional standards**

Teachers have received great attention through the existing teacher training programs on professional standards. According to Al-Fatawi (2003):

“[these] programs . . . set precise targets for teacher training, the required professional standards are clearly defined, [and] teachers are then required to take responsibility for these levels: Their trainers shall be responsible for ensuring that the specified objectives are met” (Al-Fatalawi, 2003: 32).

Makhlafi (2004) pointed to the need to focus on collective assessment and feedback during the training of student teachers in skills and professional standards, and ALkatabi (2004) explained the need to provide lists of professional competencies that contribute to the achievement of teachers' standards, which represent the aspirations of pre-and in-service teachers. Abu Sawawin (2010) underscored the need to prepare the student teacher using a variety of methods during practice.

### **The relationship between education based on professional standards and teacher education programs**

The first appearance of lists of professional standards in teacher training programs is through what Dodle (1973) did, which indicated that the first to use these lists is Kinney in 1952 through his collaboration with the California Council for Teacher Preparation so as to follow up and evaluate the performance of teachers in the general education stages. The lists of professional standards for teacher education programs have undergone a number of modifications. Since their inception in the 1960s, there has been a shift in teacher education programs, from competency-based to standards-based. This trend spread across the USA and was adopted by numerous colleges and teacher preparation institutions. It has been supported by extensive empirical research, including studies by Stanford (1976), Young and Young (1969), and Oaillems (1977). These studies focused on the importance of this trend in the development of desirable professional standards for teacher performance (Jamea, 1984: 67).

Jamea (1984) explained that education based on professional standards is unique in regard to a number of features. Adherence to a systematic plan for setting standards and developing training programs entails the following:

- Students' speed of learning and growth criteria are evident in their behavior
- The development of teachers' special abilities and standards leads to the reflection of their knowledge acquisition
- Approaching the teacher as often as possible regarding fieldwork requirements related to academic level, skills, and performance



- Focus on numerous current educational and psychological trends in the fields of education and psychology, such as self-education.
- Attention to trends in the field of education technology
- Use of different types of evaluation: diagnostic, intertribal, and structural

### **The preparation of the teacher in light of the professional standards concept**

Preparation of the teacher based on professional standards is one of the most important modern trends in the field of education and the tremendous developments regarding the use of computers and the Internet. Their vision of teacher training programs enables the mastery of new professional standards before engaging in actual work. Abdul-Samie and Hawala (2005) pointed out that in light of professional standards, preparing the teacher entails the following:

- Determining the required parameters of the teacher in the setup program.
- Training him or her on performance and practice that is contrary to what is done in preparation programs that are based on theoretical knowledge
- Including learning experience in the preparation program in the form of specific criteria that helps the teacher to perform his or her new educational roles.
- Ensuring that the preparation program meets the standards according to which the qualifications of the teacher will be assessed

### **The philosophy of teacher preparation based on professional standards and characteristics**

This can be summed up in five points:

1. The program has to be based on determining and outlining in a clear and precise manner the criteria that teachers need to meet, thereby making the student teacher more sensitive to their importance and more aware of their meaning to him or her.
2. It has to help the student teacher to see his or her progress and rely on observation and senses in light of the criteria for accurate and acceptable performance levels.
3. It should focus on the student teacher, as the supervisor is more interested in individual standards for each student teacher and is keener to provide opportunities for him or her to demonstrate in future behavior.
4. It offers training programs, processes, and evaluation that are clear, specific, and effective.
5. It develops the idea of enhancing training and providing the teacher with numerous opportunities to achieve competencies that are determined using the various means and methods available in the training activities. (Al-Khamisi, 2003)

Based on the foregone discussion it is clear that the professional standards that are determined are expected to be conveyed to the student teachers and that their awareness of these standards should help them to do their jobs more effectively and continuously improve their performance.

### **Classification of the current professional standards**

Based on the objective of the current study—to measure professional standards for student teachers; and in light of the above theoretical classifications, it is proposed that professional standards should also be classified as follows:

- Planning standards
- Classroom management standards
- The use of teaching aids standards
- Standards of teaching methods
- Evaluation standards

Researchers, such as Abdullah (2007) and AbuSwain (2010), emphasized the importance of adequate planning and the need for teachers to achieve success in the profession, as this clarifies other teachers' understanding of the objectives of education and reduces the randomness of teaching. The following are additional benefits of this emphasis:

1. It gives teachers the opportunity to review material and enhance their development by reading other sources, especially as a result of the explosion of technological knowledge, which has provided required resources that can be utilized, including through Internet networks and the various available search engines.
2. Preplanning lessons gives teachers an opportunity to choose the appropriate interaction method for the nature of the subject and the lesson.
3. Preplanning lessons gives teachers an opportunity to refine and classify the material and makes it easier for students to benefit from it.
4. It enables the achievement of set objectives within a specific time frame.
5. It makes lesson scholarly and allows for the determination of whether it has been achieved to a sufficient degree.
6. Preplanning lessons gives teachers an opportunity to prepare thought-provoking, critical, and creative questions.

According to Dahlan (20108), classroom management is important for the following reasons:

1. It provides an emotional and social climate that is conducive to learning.
2. It organizes the physical and psychological environment, ensuring its suitability for learning.
3. It provides, organizes, and directs educational experiences.
4. It enables the observation of students, follow-up on their progress, and evaluation

Classroom management is an art and a science, and it relates to the teacher's style in dealing with students both inside and outside the classroom; as well as the management of the class itself, its laws, and its procedures. The use of the Internet helps to illustrate the differing experiences of teachers of different nationalities in regard to active classroom management, and this can lead to an improvement in the teacher's performance in this regard.

It is essential that educational techniques be closely linked to the curriculum and integrated with it so that it becomes one of its basic components. ALhila (2002) believes that modern technical and technological developments have contributed to the trend of using educational techniques in general. In today's world, this is now known as the technology of education, whereby the openness of the world as a result of the use of the Internet helps to diversify educational techniques, which improve the educational process. This helps in selecting appropriate educational tools that meet the needs of learners and allow for the achievement of lesson objectives in less time and with less effort than would be the case in a world without the Internet.

Modern teaching methods vary according to the changing outlook on the nature of the education process. This outlook is dependent on conservation and amplification of knowledge and has expanded to include cognitive levels which require positive thinking on the part of the learner. The aim is to demonstrate the potential of the students and increase their potential. Traditional teaching methods are no longer suited to contemporary life. Therefore, numerous educational theories have emerged with a view to helping students' teachers to acquire many mental, social, and motor skills. The modern-day teacher's task involves providing learners with the opportunity to acquire knowledge themselves, to participate effectively in all educational activities, and to develop the skills of independent thought and self-reliance when it comes to their work.

Dahlan (2010) stated that evaluation standards are the total number of actions performed by the teacher before, during, and after the teaching process. These standards are intended to enable them to obtain quantitative data

regarding learning outcomes to enable them to assess changes in student behavior using a toolkit (verbal and written questions or the observation of specific behavior). The evaluation in education is defined as:

“a judgment on the success of the educational process to achieve the overall objectives it contains, as well as [to] promote students’ strengths and treat his weaknesses” (Dahlan, 2010: 152).

Consequently, it is important for the student teacher to search and explore every aspect that serves the educational process, including new innovations used in the field of evaluation, especially in light of the tremendous acceleration of technology and the development of evaluation competencies.

### **Life skills**

The acquisition of life skills is one of the important and desired learning outcomes based on a structured approach. Lessons about life skills are offered to learners at any stage of the educational process and are not limited to any particular subject. Life skills relate to common responsibilities that cannot be exempted from any specialization, and reference to this aspect of education is in essence concerned with the matter of the individual’s acquisition of talent, attitudes, values, and skills. They enable the individual to live with diverse people and interact with them socially in a way that leads to adaptation and the ability to work, and to participate in the process of economic, social, and political development of the individual him or herself (Greene, 2008; Hassan, 2009).

It should be noted here that many educational institutions have been defined life skills as, cognitive, social, personal, and psychological skills related to students’ handling of requirements and challenges in their daily lives. These skills vary according to different cultures, environments, circumstances, and themes, and they include decision-making, problem-solving, communication, negotiation, creative thinking, critical thinking, self-awareness, empathy, resistance to stress, planning for the future, self-assertion, discord, and listening (World Health Organization, 2003).

### **Characteristics of life skills**

Every community needs a variety of skills necessary for the individual living within it, and the quality of the skills differs for each society, according to its growth, and development. There may be similarities in terms of some general life skills that individuals are required to have. These may include skills related to decision-making and problem-solving, which can be agreed upon at all times and in all places. However, the nature and quality of the decisions and the problems facing the individual in society vary. In addition, the life skills required by individuals in society vary from one time period to another, depending on the stage of development of the society. Therefore, it cannot be determined that there are life skill characteristics that are suitable for all societies, but scientific frameworks and foundations can be developed, and based on these (Danish and Steven, 2000).

The following are the characteristics of life skills (Holt et al., 2008):

1. They vary and include both physical and intangible aspects associated with the methods of satisfying the individual’s needs and his or her requirements for interaction with life.
2. They depend on the nature of the relationship between the individual and society and their impact on each other.
3. Their aim is to help the individual to successfully interact with other people, and to develop coping methods to deal with regular daily life situations, as well as new ones that might develop.

This also include the ability to solve personal or social problems, face daily challenges, make adjustments and improvements in the style and quality of one’s life as an individual and a member of society. In addition it should also include measuring the strengths and weaknesses with regard to the life skills of the individual by assessing

the strengths and weaknesses of his or her choices. The life skills are strong if the person is able to do all the things in the aforementioned list, and whenever his or her choices are poor, this is a reflection of his or her poor life skills.

It is clear from the above that life skills consist of cognitive components of how behavioral decisions are made. The emotional components that drive the choice of behavioral style and the technical components are represented in the manner in which the individual implements his or her skills. Accordingly, the researcher defines procedural life skills as mental, emotional, and sensory abilities, which enable the individual to solve problems, face the challenges of daily life, and make adjustments to individual and community lifestyles.

### **Factors influencing the individual's acquisition of life skills**

A few factors that influence an individual's acquisition of the required life skills are presented here:

- Subsidized relationships: The presence of support of family and friends for skill acquisition. In the absence of these relationships of support, the individual tends to neglect the skill, while the presence of this support positively affects the learning of the skill.
- Models: The individual should note the models to implement the skill and should practice, simulate, and imitate them.
- Reward sequence: Receiving encouragement and praise and being shown compassion is basic rewards in the formation of a life skill.
- Instruction: Most life skills instruction is obtained from home, school, and university. There are instructions for how to study and maintain one's health, and these must be followed closely at home school and university.
- Opportunity: Dependence on others makes it difficult for students to acquire life skills, as they need opportunities to practice them independently.
- Interaction with others: Learning skills from colleagues and the surrounding environment may be helpful or harmful, depending on the nature of the skills and the colleagues.

### **Life skills classification**

There is no standardized classification of life skills. These skills are determined based on knowledge of students' needs and aspirations, as well as the problems that arise when students lack these skills. Students will be expected to learn skills from others and to go back to the models and instruction for life skill acquisition, as determined by specialists. Al-Omari (2013) states that life skills are classified as follows:

- Communication and interpersonal skills, including verbal and nonverbal communication, as well as the ability to listen, express one's feelings, and make observations
- Negotiation and rejection skills, including conflict management, confirmation skills, and rejectionist skills
- Emotional skills (emotional understanding and empathy), including the ability to listen to the needs and circumstances of others while understanding and expressing this understanding
- Collaboration and teamwork skills, including expressing respect, and assessing another person's abilities and his or her contribution to the group
- Advocacy skills, including persuasion, motivation, decision-making, and thinking abilities.
- Information-gathering skills, including the ability to assess future results, identify alternative solutions to problems, and analyze skills related to the impact of the values, self-orientation, and attitudes of others being able to do all these when there is stimulus.
- Critical thinking skills, including interpersonal skills analysis; interpersonal skills; the ability to analyze trends, values, social norms, and beliefs; the ability to identify sources of information; interpersonal skills; and self-management

- Skills to increase the focus of the inner mind of the child, including self-esteem and interpersonal skills, as well as self-awareness, goal setting, and self-assessment skills.
- Emotional management skills, including interpersonal skills related to grief and anxiety; and skills to deal with loss, trauma, and abuse
- Stress management skills, including those related to time management, positive thinking, and relaxation

The individuals' choice of life skills will vary, and focus depends on the individual and local conditions. Ultimately, it is the interaction of skills that produces great behavioral outputs. The need to pay attention to life skills and to provide every learner with them can be difficult due to the modern changes and challenges of this era, as well as the learner's academic performance of the work required of the learner. These skills enable the achievement of successful coexistence, adaptation, flexibility, and success in both the personal and the professional areas of one's life.

### **3. Methodology**

The researcher will use the descriptive method of analyzing the content to prepare the evaluation card for the e-portfolios of student teachers. The researcher followed the semi-experimental approach. This involves making a change to the independent variable and observing what happens to the dependent variables. This study seeks to answer the following questions:

1. What e-portfolio content is required for the development of professional standards for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?
2. What is the level of mastery required for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University to be able to use e-portfolios?
3. What is the effect of the use of e-portfolios on the development of professional standards for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?
4. What is the effect of using e-portfolios on the life skills development of student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?
5. Are there any statistically significant differences between the average pre- and post-application student teachers in the College of Education at Princess Noura Bint Abdul Rahman University based on the checklist of professional standards?
6. Are there any statistically significant differences between the average pre- and post-application student teachers in the College of Education at Princess Noura Bint Abdul Rahman University in terms of the life skills scale?

#### **Study community**

The study community will consist of all senior students specializing in primary education (110) enrolled in the Field Training in Primary School course in the first semester of the 2018/2019 school year.

#### **The study sample**

The simple randomized method will be used to extract a representative sample of the study population that is 35 senior students specializing in primary education and enrolled in the Field Training in Primary School course in the College of Education.

#### **Study tools**

To achieve the objectives of the study, the study tools comprised the following:

1. Checklist of professional standards
2. E-portfolio evaluation cards (checklists)

### 3. Life skills scale

#### **Checklist of professional standards**

The researcher has formulated a checklist of professional standards by studying the literature on education and reviewing previous research related to the problem of studying. In addition to this they should have benefited significantly from the assessment cards reflecting the primary grades of the student teachers in the Faculty of Education at Princess Noura Bint Abdul Rahman University. Some of the evaluation cards of students enrolled at other Saudi universities were also viewed.

The list of professional standards was prepared based on five areas: planning (12 standards), classroom management (6 criteria), use of teaching methods (7 standards), use of teaching aids (7 standards), and assessment (8 standards).

#### **Tool validation**

The checklist of professional standards was presented to a number of arbitrators, who were asked to express their views on the clarity of each paragraph. The arbitrators made important observations, based on which the researcher made the necessary amendments. Accordingly, the paragraphs (37) that were agreed upon by the arbitrators were chosen for their validity.

#### **Internal consistency**

The final checklist of professional standards was estimated by calculating the Cronbach's alpha coefficient. Based on the aforementioned, the professional standards are characterized by a high degree of honesty and consistency.

#### **E-portfolio evaluation card (checklist)**

##### **Building checklists**

The researcher relied on previous studies of portfolios as the main source from which to derive the primary objectives that will be achieved. The literature in this field emphasized three purposes: gathering experiences, selecting the best portfolios, and enabling growth by identifying weaknesses and strengths.

##### **Tool validation**

The checklists were presented to a group of faculty members and educational supervisors. After the researcher reviewed the notes, the amendments were made; these were limited to clarifying the meaning of some paragraphs.

#### **Stability through the use of other analysts**

Three e-portfolios were analyzed and evaluated by the researcher and two colleagues. The stability of the portfolios was calculated using the holistic equation, which shows that the ratio of the agreement between the researchers with the two analysts was 95.4.

#### **Life skills scale**

The questionnaire consisted of 37 words divided into four dimensions that address the most important life skills of the teacher (interpersonal, decision-making, problem-solving, and academic).

##### **Tool validation**

The scale was presented to a number of arbitrators, who were asked to express their views on the clarity of each paragraph. The arbitrators made important observations, based on which the researcher made the necessary amendments. The paragraphs (37) agreed upon by the arbitrators were chosen.

##### **Stability of the tool**

The researcher used the Cronbach's alpha method to determine a invariable coefficient, which was higher at 0.793. This indicates that the questionnaire has a high degree of stability.



### Statistical methods

The researcher used a number of statistical methods like percentages, arithmetic mean, Cronbach's alpha, t-tests, and ETA square  $\eta^2$  c.

## 4. Results

### Results of the first question

"What e-portfolio content is required for the development of professional standards for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?"

To answer this question, the researcher examined previous studies of e-portfolios, in addition to a list of the contents of the files and paper portfolios of student teachers enrolled in other Saudi universities. Additionally, the researcher benefited from the websites of some Arab and foreign universities interested in using e-portfolios for student teachers.

### Results of the second question

"What is the level of mastery required for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University to be able to use e-portfolios?" To answer this question, the researcher used a t-test for one group to compare the average score of the student teachers based on the assessment of the e-portfolios according to the checklists (teaching experiences, best work, strengths, and weaknesses) in the selected value (degree of mastery equaling 75%, as identified by an experienced consultant) and so on, as shown in the Table 1:

**Table 1.** T-test for one group to compare the average students' scores (sample)  
E-portfolio score card for the compilation of experience (selected value: 75%)

Checks	Arithmetic mean	Standard deviation	average percentage (default)	average percentage (actual)	T value	Significance level
Introduction	5	0	75%	100%	0	0
Field of planning	4.7	0.19	75%	94%	120.5	Function statistically at0.01
Scope of classroom management	3.8	0.72	75%	75.8%	23	Function statistically at0.01
Scope of use of teaching methods	3.9	0.89	75%	77%	17.28	Function statistically at0.01
Scope of use of teaching aids	4.5	0.64	75%	92%	38.91	Function statistically at0.01
Scope of evaluation	3.8	0.46	75%	76%	36.5	Function statistically at0.01
Total grade	4.3	0.39	75%	85.9%	49.5	Function statistically at0.01

It is clear from the table above that significant differences exist in the average grades of the student teachers (sample study) based on the e-portfolio assessment cards for the compilation of experience (selected value: 75%), as all the relative weights of the actual mean are above the default percentage. This is because of the student teachers' awareness of the parameters for the e-portfolios and their importance, the steps to be prepared, the criteria to be assessed, and the feedback they will receive. This information was obtained while the researcher and her peers viewed and discussed the files, which displayed some examples of e-portfolios.



**Table 2.** T-test for one group to compare the average student teachers' scores (sample)  
E-portfolio score card for the best work (checklist and selected value: 75%)

Checks	Arithmetic mean	Standard deviation	average percentage (default)	average percentage (actual)	T value	Significance level
Field of planning	4.3	0.18	75%	88%	29.5	Function statistically at 0.01
Scope of classroom management	4.8	0.62	75%	78.8%	27.4	Function statistically at 0.01
Scope of use of teaching methods	3.9	0.89	75%	87%	31.28	Function statistically at 0.01
Scope of use of teaching aids	3.5	0.84	75%	92%	32.91	Function statistically at 0.01
Scope of evaluation	3.8	0.36	75%	86%	34.5	Function statistically at 0.01
Total grade	4.4	0.39	75%	88.9%	30.5	Function statistically at 0.01

It is clear from the Table 2 above that significant differences exist in the average grades of the student teachers (sample study), based on the e-portfolio assessment cards for the best work checklist and selected value (75%), as all the relative weights of the actual mean are above the percentage for the default. This is due to the students' awareness of the criteria that will be evaluated, based on a list of their best work. The portfolio explains the reason for choosing the best work, links its importance to evidence, and ponders the work and criticisms of its conclusions written in the correct language.

**Table 3.** T-test for one group to compare the average student teachers' scores (sample)  
E-portfolio score card showing strengths and weaknesses (checklist and selected value: 75%)

Checks	Arithmetic mean	Standard deviation	average percentage (default)	average percentage (actual)	T value	Significance level
Field of planning	4.7	0.13	75%	80%	35.3	Function statistically at 0.01
Scope of classroom management	3.8	0.82	75%	79.8%	65	Function statistically at 0.01
Scope of use of teaching methods	3.9	0.91	75%	77%	52.6	Function statistically at 0.01
Scope of use of teaching aids	4.5	0.64	75%	80.3%	48.91	Function statistically at 0.01
Scope of evaluation	3.8	0.46	75%	80%	52.5	Function statistically at 0.01
Total grade	4.3	0.41	75%	79.3%	58.5	Function statistically at 0.01

It is clear from the Table 3 above that significant differences exist in regard to the average grades of the student teachers (sample study) based on the e-portfolio assessment cards, which include the strength and weakness checklist, and all the relative weights of the actual mean are above the default percentage of 75%. This is due to self-feedback on some contents of the e-portfolios prepared by the student teachers: video clips, audio recordings, and peer feedback. This helped the researcher to identify weaknesses in order for these areas to be improved, as well as strengths to be further strengthened.

**Table 4.** T-test for one group to compare the average student teachers' scores (sample)  
E-portfolio score cards containing strengths and weaknesses (checklist and selected value: 75%)

Checks	Arithmetic mean	Standard deviation	average percentage (default)	average percentage (actual)	T value	Significance level
teaching experiences	4.3	0.33	75%	85.6%	35.3	Function statistically at 0.01
Best work	4.8	0.72	75%	89.8%	65	Function statistically at 0.01
Strengths and weaknesses	3.9	0.26	75%	79.5%	52.5	Function statistically at 0.01
Total grade	4.3	0.39	75%	84.3%	58.5	Function statistically at 0.01

It is clear from the Table 4 above that there are significant differences in the average grades of student teachers (study sample), based on the e-portfolio score cards and the selected value (75%). All the relative weights of the actual average are above the percentage of the default mean. The access of the study group members to their ability to achieve this level of proficiency (75%) can be explained by the student teachers' awareness of the parameters of the e-portfolios, their importance, the steps involved in their preparation, and the standards that will be evaluated. This is in addition to the feedback they received from the researcher and her peers while they viewed the file. Some examples of e-portfolios were presented and discussed with the student teachers. A determination about the objectives was made in terms of the achievements of the e-portfolios containing the compilation of experiences and the selection of the best work. The aim was to identify strengths and weaknesses and to present the files in front of their peers, as this helped to increase their self-confidence, as well as competition among themselves. It also helped the researcher to clarify how to deal with photos, video recordings, and audio recordings using simple technology, such as cellular phones, as well as some of the multimedia programs that students used to make their files attractive.

The results of the present study are consistent with those obtained by Dessouki (2010) and Ismail (2005), whose research concluded that e-portfolios are an exciting and easy-to-use technical tool that is more usable than its traditional counterpart. E-portfolios can be used in various courses. In addition there is the possibility of e-portfolios being used by faculty members as teaching files.

### Results of the third question

“What is the effect of the use of e-portfolios on the development of professional standards for student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?” To answer this question, the researcher used the ( $\eta^2$ ) ETA square and (d) value, which reflect the magnitude of the impact of the differences between the pre -and post-application development of teaching competencies (Table 5):

**Table 5.** Suggested reference table for determining the volume of impact levels for each measure of impact size

Tool used	Effect size		
	small	Medium	Large
$\eta^2$	0.02	0.07	0.17
d	0.3	0.4	0.7

**Table 6.** The magnitude of the effect of the differences between the dvalue and the significance level, the ETA value, the t-value, the value of the t-test, and the post-application teaching competencies

Checks	t-value	( $\eta$ )Value	d -value	effect size
Field of planning	143.3	0.99	38.3	significant
Scope of classroom management	102.2	0.99	26.4	significant
Scope of use of teaching methods	80.3	0.99	17.6	significant
Scope of use of teaching aids	61.5	0.99	16.91	significant
Scope of evaluation	65.8	0.99	18.5	significant
Total grade	125.3	0.99	32.5	significant

The Table 6 above shows that the impact sizes of the independent variable (e-portfolios) is greater than 0.8, thereby indicating that the d of the dependent variable (professional standards) is significant. This is because the use of e-portfolios has a significant impact on the development of professional standards among the student teachers based on the sample's study parameters.

The e-portfolios, which contain lesson plans, audio recordings, video recordings, and multiple other contents, provide a rich environment for self-evaluation through meditation. This, in turn, provides valuable opportunities for students to think about their lessons and decide whether their teaching objectives have been achieved. This reflection serves as a framework for the student's self-assessment in addition to enabling peer assessment in the form of feedback received by the student teacher from his or her colleagues in the viewing classes. They are able to discuss their experiences via the Internet, as well as the diverse sources of information.

The Internet enables the use of printed (e.g., books and magazines) and other materials (e.g., tapes and films) obtained from different educational sites and multiple sources. The student teacher is able to collect some of the contents of the e-portfolios, such as, information about how to enrich the class environment, the appropriate teaching methods, experience in the field of classroom management, and so on. One of the many features is the sheer volume of information, which enables the provision and review of numerous and diverse educational ideas and modern pedagogical methods that lead to a reduction in effort, time, and cost.

### Results of the fourth question

“What is the effect of using e-portfolios on the life skills development of student teachers in the College of Education at Princess Noura Bint Abdul Rahman University?”To answer this question, the researcher used ( $\eta^2$ ) ETA square and the (d) value, which both reflect the magnitude of the impact of the differences between the pre - and post-application development of certain life skills (Table 7).

**Table 7.** Suggested reference table for determining the volume of the impact levels for each measure of impact size

Tool used	Effect size		
	small	medium	Large
$\eta^2$	0.03	0.08	0.18
d	0.3	0.4	0.6

**Table 8.** The magnitude of the effect of the differences between the application and the significance level, the ETA value, the value of the t-test, and the post-application life skills of student teachers

Skill	t-test	( $\eta$ ) value	D-value	effect size
Interpersonal communication	141.6	0.99	36.3	significant
Decision-making	104.2	0.99	23.4	significant
Problem-solving	78.3	0.99	15.6	significant
Academic	71.5	0.99	14.91	significant
Total	130.3	0.99	34.5	significant

The Table 8 above shows that the impact size of the independent variable (e-portfolios) is greater than 0.8, thereby indicating that (d) of the dependent variable (life skills) is significant. This is because the use value of the e-portfolios has a significant impact on the development of life skills among student teachers based on the sample's study parameters.

The results showed the impact of the quality of student teachers' life skills that lead to the development of their academic achievements. The acquisition of life skills encourages them to engage in scientific research and discovery, which are directly related to the lives of the students and the people in their communities. It also increases their cognitive output and the depth and breadth of their knowledge of concepts acquired from previous lessons. As a result, in-depth reflection and discussion of ideas contribute to their strong desire to address issues by examining them from several points of view that lie outside of traditional-thinking frameworks.

### Results of the fifth question

“Are there any statistically significant differences between the average pre- and post-application student teachers in the College of Education at Princess Noura Bint Abdul Rahman University based on the checklist of professional standards?” To answer this question, the researcher used a t-test for two related groups to compare the average grades of student teachers based on the checklist of professional standards for student teachers between the pre- and post-tribal applications, as shown in the following table (Table 9):

**Table 9.** The mean, standard deviation, t-test, and significance level of group members in the pre- and post-application stages in terms of the professional standards of the student teachers

Areas	Application	Arithmetic mean	Standard deviation	Value of T	Level of significance
Field of planning	pre	2.3	0.18	143.16	Function statistically at 0.01
	post	4.8	0.19		
Scope of classroom management	pre	2.1	0.31	101.29	Function statistically at 0.01
	post	4.5	0.29		
Scope of use of teaching methods	pre	2.4	0.30	68.18	Function statistically at 0.01
	post	4.9	0.29		
Scope of use of teaching aids	pre	2.2	0.29	64.13	Function statistically at 0.01
	post	4.7	0.30		
Scope of evaluation	pre	2.5	0.18	63.63	Function statistically at 0.01
	post	4.9	0.19		
Total grade	pre	2.2	0.17	125.01	Function statistically at 0.01
	post	4.7	0.16		

From the previous table it can be seen that there are differences in the mean scores of student teachers, based on the checklist of the professional standards of student teachers in the College of Education at Princess Noura Bint Abdul Rahman University, between the pre- and post-application stages in all fields, and the overall scores of the scale favor the post-application stage. Additionally, the results of this study are consistent with those of Dessouki

(2010), Saqr (2006), Al-Ahmad (2003), and Bakkar et al. (2003), which concluded that e-portfolios facilitate the professional growth of student teachers by enabling them to contemplate their practice. Student teachers have greater opportunities to meditate and reflect on their experiences.

### Results of the sixth question

“Are there any statistically significant differences between the average pre- and post-application student teachers in the College of Education at Princess Noura Bint Abdul Rahman University in terms of the life skills scale?” To answer this question, the researcher used a t-test for two related groups to compare the average grades of student teachers on the life skills scale between the pre- and post-tribal applications, as shown in the following table (Table 1):

**Table 10.** The mean, SD, t-test, and significance level of group members related to the life skills of student teachers in their pre- and post-application stages

Skills	Application	Arithmetic mean	Standard deviation	Value of T	Level of significance
Interpersonal	pre	2.1	0.17	141.26	Function statistically at 0.01
	post	4.9	0.18		
Decision-making	pre	2.2	0.30	104.21	Function statistically at 0.01
	post	4.9	0.28		
Problem-solving	pre	2.1	0.31	65.14	Function statistically at 0.01
	post	4.8	0.27		
Academic	pre	2.1	0.28	62.23	Function statistically at 0.01
	post	4.8	0.31		
Total	pre	2.1	0.16	128.01	Function statistically at 0.01
	post	4.8	0.18		

The table shows that with regard to the life skills scale, there are differences in the mean score of the student teachers at the College of Education at Princess Noura Bint Abdul Rahman University between the pre- and post-application stages in all fields, and the overall score of the scale favors the post-application stage.

This finding can be attributed to the fact that the use of e-portfolios that are based on life skills has helped student teachers to interact effectively, ask questions, and benefit from their previous knowledge and experiences, which link them to new knowledge and current information. This results in the expansion of student teachers' experience and the generation of new, in-depth information, which is further enhanced by the collection of concepts and knowledge to be derived from field training. It increases their motivation to learn, and helps them to interact to promote knowledge and new realities. It also encourages dialogue about the issues that are at the core of teaching, provides the opportunity for all students to participate actively in the learning process, and causes cognitive structures to be more coordinated and organized, thereby contributing to an increase in academic achievement.

Wafi (2010) confirmed the effectiveness of the Life Skills Education Program in improving the concept of self-learning, and this is in line with the findings of Papacharisis, Goudas, Theodorakis, and Danish (2005). These studies underscore the importance of methods that are based on the use of positive reinforcement, collective participation, dialogue, debate, modeling, feedback, and role playing in the development of students' life skills, such as positive thinking, personal responsibility, and academic achievement. This emphasizes the superiority of teaching that is based on life skills over traditional methods of education in the development of educational attainment.

## Conclusions

The findings of this study reveal that the use of e-portfolios improves capabilities, skills, and knowledge. It encourages student teachers to know about tendencies, trends, and interests by preparing the file and making the effort to compile its contents. It also ensures that it is well presented so that it can be used to channel learning in the appropriate direction—that is, in keeping with the students' abilities and tendencies—to enable productivity.

E-portfolios reveal the strengths and weaknesses of student teachers. It can help them to avoid their weaknesses, enhance their strengths, and contribute to the appropriate programs that prepare student teachers. This would enable them to improve and develop these programs based on the data that are collected through the student teachers' e-portfolios. This saves time and effort and is more orderly than the use of paper files. E-portfolios help the students identify the results of their progress and give them clear ideas about their performance through the comments received from their educational supervisors, teaching colleagues, and/or peers. This feedback gives them a clear idea of their deficiencies and how to improve their performance. In addition, it enables the exchange of diverse experiences through the Internet.

The use of e-portfolios contributes significantly to motivating student teachers through the handling of multimedia programs used to display the contents of their e-portfolios in an organized way. It also helps them to use the Internet to send emails, receive comments, and search for new information and knowledge. This gives them a clear vision of the most important developments related to the field of education. E-portfolio use also allows student teachers to work more efficiently, especially in regard to structural assessments, due to the possibility of modifying the contents of the file.

E-portfolios provide real-life opportunities for student teachers to engage in self-learning by undertaking self-directed activities, which include tasks such as solving problems, making decisions, and cooperating with others. These tasks increase their motivation to learn, which contributes to the long-term improvement of their self-concept. They benefit from these improved attitudes to education in their future lives. This also enhances their independence, encourages them to take responsibility for their learning, and increases their interest in learning and their willingness to confront educational situations. It also contributes to the development of their tendencies to satisfy their needs and refine their talents, which, in turn, helps to raise the performance level and skills of student teachers.

Finally, e-portfolios contribute to the diversity of content, as they combine learning processes and evaluations through an in-depth understanding of the work (contemplative thinking) and the provision of appropriate feedback. Using e-portfolios causes the role of traditional student teachers to change, as the student teacher becomes an inventor who searches for information and knowledge by reviewing different sources, such as libraries and the Internet, as well as teachers and supervisors. They also attend conferences and seminars. These actions allow students to expand their horizons to coincide with the latest developments of this era. Additionally, the use of e-portfolios contributes significantly to the change from a traditional to an electronic environment in the educational process. It is expected that the findings of the study will be of great importance to educators and student teachers in their quest for excellence.



## References

- Abdullah, A. (2007). Teaching competencies for teachers in secondary schools in Medina Aden from the point of view of the teachers themselves. *Journal of Educational Studies and Research*, 9, 208-22.
- Abdul-Samie, M., Hawala, S. (2005). Teacher Preparation. Amman, Jordan: Dar Al Fikr.
- AbuSwain, R. (2010). Educational Qualifications for Teachers Students A classroom teacher at the Faculty of Education at Al-Azhar University, from their point of view, in the light of their training needs. *Islamic University Journal, Series of Humanities Studies*, 18, 2-38.
- Aga, H. (2012). *Using the files of achievement and collaborative learning in developing the skills of expressionCreative writing for 10<sup>th</sup> grade students in Palestine*. Unpublished PhD thesis Mansoura, Egypt, Ain Shams University: Faculty of Education.
- Al – Omari, J. (2013). The extent to which Jordanian university students are aware of life skills In light of the knowledge economy. *Journal of Psychological and Educational Studies*, 10.
- Al Masad, A. (2012). Learners' perceptions of the E-portfolios in learning and evaluation. *Studies in University Education - Egypt*, p. 23-44.
- Al-Khamisi, S. (2003). The attitude of the student teachers about the effectiveness of supervising educationOperation in the Middle Colleges of Teachers and Teachers in the Sultanate of Oman .Egypt-Alexandria: Dar El Wafaa Printing & Publishing.
- Andreson, R.S. & DeMuelle, L. (1998). Portfolio use in twenty four teacher education programs, *Teacher Education Quartely*, 25, 23-31
- Ayad, F. & Saaduddin, H. (2010). The effectiveness of a proposed scenario for including some life skills in the technology course for the tenth grade in Palestine. *Al-Aqsa University Journal, Human Sciences Series*, 1(14).
- Barrett, H. C. (2007). Research Electronic Portfolios and learner engagement: The REFLECT Initiative, *Journal of Adolescent and Adult Literacy*, 50(6), 436-449.
- Buckley, S., Coleman, J., & Khan, K. (2010). Best evidence on the educational effects of undergraduate portfolios. *Clinical Teacher*, 7(3), 187–191. <http://doi.org/10.1111/j.1743-498X.2010.00364.x>
- Chatham, A., Seawel, L., & Raschig, J. (2009). Avoiding the pitfalls: Current practices and recommendations for ePortfolios in higher education. *Journal of Educational Technology Systems*, 38(4), 437–456. <http://doi.org/10.2190/ET.38.4.e>
- Chau, Y., Cheng, M. (2010). *EFL Instruction and assessment with portfolio: ACase study in Tawin*. National Chung Cheng University, Taiwan.
- Constantine, H. & Lorenz, M. (2004). *Professional Achievement Profile, Distinguished Teacher's Guide*, Palestine: University Book House.
- Dahlan, O. (2010). *Teacher in Education and Learning*. Palestine, Gaza: Afaq Library.
- Danish, H. & Steven, V. (2000). New Roles for Sports Psychologists: Teaching Life Skills Through Sport to At- Risk Youth. *Quest Human Kinetics*, 49(1), 100 - 14.
- Deneen, C., & Shroff, R. (2010). *E-Portfolio use in two institutes of higher education: Acomparative case study*. Proceedings of the European Conference on eLearning, 92–100.
- Dietrich, J. W., & Olson, C. (2010). In quest of meaningful assessment of international learning: The development and implementation of a student survey and e-Portfolio approach. *JGE: The Journal of General Education*, 59(3), 143–158.
- Fatalawi, S. (2003). *Teaching competencies: Concept - Training – Performance*. Jordan: Dar Al Shorouk.
- Fenwick, T., & Parsons, J. (2009). *The art of evaluation*. Toronto: Thompson Educational Publishing.
- Gartner, I. (2011). *Hype Cycle Research Methodology*, Retrieved from <http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp>
- Gordon, M. (2009). Toward a Pragmatic Discourse of Constructivism, Reflections on Lessons from Practice, *Journal of Teacher Education*, 24(1), 17-20
- Granberg, C. (2010). E-portfolios in teacher education 2002–2009: The socialconstruction of discourse, design and dissemination. *European Journal of Teacher Education*, 33(3), 309–322. <http://doi.org/10.1080/02619761003767882>



- Greene, H. A. (2008). *Learn from Yesterday, Live for Today, Hope for Tomorrow: The Development of A life Skills Scale*. Oxford, OHIO, Miami University. Available online at: <http://rave.ohiolink.edu/etdc/view?acc%5Fnum=miami1213282018>
- Hallam, G., & Creagh, T. (2010). E-Portfolio use by university students in Australia: A review of the Australian e-Portfolio Project. *Higher Education Research & Development*, 29(2), 179–193. <http://doi.org/10.1080/07294360903510582>
- Hassan, A. (2009). *The Effect of Teaching on the Model of Witley on the Achievement of Sixth Grade Students in Science and the Development of Their Attitudes towards them*. Egyptian Association for Curriculum and Teaching Methods, Faculty of Education, Ain Shams University, No. 137.
- Holt, N. L and others (2008). Do Youth Learn Life Skill through Their Involvement in High School Sport? A Case Study, *Canadian Journal of Education*, 31(2), 281-304 <http://www.csse.ca/CJE/General.htm><http://www.omanls.cnet/>
- Jamea, H. (1984) Teaching competencies For the primary school teacher in the State of Kuwait. *Educational Journal*, 1(2).
- Lowendahl, J.-M. (2011). Hype Cycle for Higher Education, 2011. Retrieved from [http://www.gartner.com/DisplayDocument?id=1755718&ref='g\\_fromdoc'](http://www.gartner.com/DisplayDocument?id=1755718&ref='g_fromdoc')
- Makhlafi, A. (2004) The Impact of Community Assessment and Feedback on the Development of Educational Efficiency in Female Teachers in Taiz University, *Research and Educational Studies*, p. 2, Yemen: Taiz University: Faculty of Education.
- Mazen, H. (2009). Practical Education to employ IT skills in the design, preparation and use of E-portfolios, *Journal of the Egyptian Association for Practical Education*, Special issue The thirteenth scientific conference (2-4).
- Mulla, F. (2004). The Effectiveness of Using the Micro Teaching Method in the Development of Some Instructional Competencies of Teaching Students at the Department of Physical Education, University of Bahrain. *Educational Journal*, 18, 72.
- Papacharisis, V., Goudas, M., Theodorakis, Y and Danish, S. J. (2005). The Effectiveness of Teaching a Life Skills Program in a Sport Context, *Journal of Applied Sport Psychology*, 17, 247–254. <http://doi.org/10.1080/10413200591010139>
- Paulson, F., Paulson, P., and Meyer, C. (1991). What Makes a Portfolio?, *Educational Leadership*, 48(5), 60-63.
- Qutait, G. (2009). *Computerization of the classroom calendar*, Amman: House of Culture.
- Sulphey, M. M. & Al Kahtani, N. S. (2017). Economic security and sustainability through social entrepreneurship: the current Saudi scenario, *Journal of Security and Sustainability Issues* 6 (3), 479–490. [http://dx.doi.org/10.9770/jssi.2017.6.3\(12\)](http://dx.doi.org/10.9770/jssi.2017.6.3(12))
- Sulphey, M. M. & Al-Kahtani, N. S. (2018). Academic Excellence of Business Graduates through Nudging: Prospects in Saudi Arabia, *International Journal of Innovation and Learning*, 24(1), 98-114. <http://doi:10.1504/IJIL.2018.10013022>
- Sulphey, M. M. (2017). Game based learning as an aid for extenuating Higher Education Sector issues – The case of Saudi Arabia. *International Journal of Simulation, Systems, Science and Technology*, 18 (1), 6.1-6.10. <https://doi.org/10.5013/IJSSST.a.18.01.06>
- Sulphey, M. M., AlKahtani, N. S. & Syed, A. M. (2018). Relationship between Admission Grades and Academic Achievement, *Entrepreneurship and Sustainability Issues*, 5(3) [http://doi.org/10.9770/jesi.2018.5.3\(17\)](http://doi.org/10.9770/jesi.2018.5.3(17))
- Tindall-Ford, S., Waters, K., & Johnson, N. F. (2010). An evaluation of a web-based e-portfolio system in an Australian pre-service teacher education program. *International Journal of Learning*, 17(4), 297–308.
- Tkacova, A., Kubak, M., Androniceanu, A., Tvaronavičienė, M., Huculova, E. (2018). Financial literacy of students in chosen universities – research platform for regulatory processes of educational system in Slovakia, *E + M. Economics and Management* 21(1): 175-190 <https://doi.org/10.15240/tul/001/2018-1-012>
- Winsor, P., Burr, R., & Reeves, H. (1999). Portraying Professional Development in Preservice Teacher Education: Can portfolios do the job? *Journal of Teachers and Teaching: Theory and Practice*, 5(1), 9-30. <http://dx.doi.org/10.1080/1354060990050102>
- Young, D. and Young, D. (1969). *The Effectiveness of individually Prescribed Micro Teaching Module on An intern subsequent classroom performance*. Paper Presented at the annual Meeting of American Educational Research Association.

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## ANALYSIS OF FINANCIAL LITERACY TENDENCIES WITH YOUNG PEOPLE\*

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**Abstract.** The following skills, such as planning of personal finances, formation and diversification of savings, augmentations of personal capital, and open-mindedness to new initiatives in the entrepreneurship activities, enhance the financial sustainability of the population, and are decisive for their life quality. Every person in certain circumstances can be financially and economically active, if s/he has got such competence as financial literacy which is much more important in the course of life than the level of income or professional qualifications, because, hereafter the governing factor will be not the possession of financial instruments by the person, but skills of effective management for the achievement of one's own objectives. Knowledge of financial matters at a young age makes administration of finances much easier when becoming adult, getting education, or joining the labor market. At the same time the necessity of improving the financial literacy among young people and educating schoolchildren is more and more discussed. Taking into consideration the fact that young individuals are a significant factor for the development of national economy, substantial improvement of young people's financial literacy is essential. Young people with a high level of financial literacy would be those who could give greater contribution to state economy, so it is important to research the level of financial literacy among young people. The objective of the present research is to analyze the financial literacy of young people in Daugavpils. Methods used in the research: monographic method – theoretical description of financial literacy, graphical method – graphical representation of obtained

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Cultural Heritage and Identities of Europe's Future

results, interview method (questionnaire) – data acquisition required for the research, statistical method – analysis of statistical information, comparative method – description of the obtained data and drawing conclusions. The financial literacy of Daugavpils youth has been researched and evaluated. The results of the questionnaires show that more than half of respondents have given good estimates of their financial literacy; however, at the same time research results prove that the overall level of financial literacy is not sufficiently high.

**Keywords:** financial literacy; financial literacy index; financial products; young people; Daugavpils

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**JEL Classifications:** G32, G20, H31, L26, M10

## 1. Introduction

There is a growing awareness for the need to facilitate the understanding of each individual and each household about the world of finance, its offers and possible risks, as financial services are nowadays available to everyone. Hence, it is important for each person to successfully operate his/her finances in order to gain stability in life and provide oneself and the surrounding people with welfare. Financial literacy affects not only a person's quality of life (Organisation for Economic Co-operation and Development, 2014; Latvijas Universitāte, 2017), but also sustainable economic development in general, development of entrepreneurship, and improvement of business environment (Pietrzak *et. al.* 2017; Ohotina *et al.* 2018a; Fabuš, 2017; Michailova *et. al.* 2017).

As concerns such seemingly obvious matters as skills of using simplest financial services, ability of being aware of one's financial limitations, changing them, and constantly striving for greater personal well-being, the notion of financial literacy is related not only to economy but also management, psychology, pedagogy and many other branches of science.

The demographic situation in Latvia is growing worse with each year. The decrease of the number of population has mostly been conditioned by the negative natural growth and emigration. The society is constantly growing older. The number of young people in Latvia has decreased in relation to the overall number of able-bodied population in the country. For this reason, taking into consideration that young people make an essential factor of national economy development, it is necessary to improve their financial literacy and entrepreneurship capacity. Young people with a high level of financial literacy would be those who could make a greater contribution to national economy, hence it is important to study the level of financial literacy among youths.

The topicality of the research is justified by the fact that, both in society and among decision makers in state institutions and enterprises, there is an on-going discussion on the improvement of the financial literacy of the population of Latvia, including young people.

The aim of the present research is studying and analysing the financial literacy of young people in Daugavpils.

The objectives of the research:

- studying theoretical sources on the notion of financial literacy and methods of financial literacy assessment;
- assessing the financial literacy index and sub-indexes of Latvian population;
- carrying out a survey of young people in Daugavpils aimed at investigating their financial literacy.

Methods used in the research: monographic method – theoretical description of financial literacy, graphical method – graphical representation of obtained results, survey method (questionnaire) – data acquisition required

for the research, statistical method – analysis of statistical information, comparative method – description of the obtained data and drawing conclusions.

## 2. Theoretical aspects of financial literacy

Financial literacy is defined as a complex of understanding, knowledge, skills, and attitudes necessary for making appropriate financial decisions leading to individual financial wellbeing (Organisation for Economic Co-operation and Development, 2015). Researching financial literacy is a growing area in educational and social research (Organisation for Economic Co-operation and Development, 2014). A person who understands financial issues is knowledgeable not only in the sphere of finance but economy on the whole and can apply this knowledge for promoting his/her future wellbeing and financial growth to reach private financial goals (Finanšu un kapitāla tirgus komisija, 2015).

Properly designed financial education has the potential to encourage innovation and help improve access and use of financial services (Njaramba *et al.*, 2015). Financial literacy is relevant for sustainable development as well as business environment. Since the beginning of the 20<sup>th</sup> century, researchers from different countries have started to become interested in the economic and financial risks as factors that influence entrepreneurial environment and conditions in which the investment activity happens (Pietrzak *et al.* 2017; Kozubikova *et al.* 2017; Ohotina *et al.* 2018a; Ohotina *et al.* 2018b Jankelova *et al.* 2018; Tvaronavičienė 2018).

Effective financial management positive influence on innovation industry and entrepreneurship (Botric, & Bozic, 2017; Illmeyer *et al.*, 2017). Finance management is the most crucial element that has acquired potential magnitude in an integrated manner with the management of innovations (Laužikas *et al.*, 2017; Fabuš, 2017).

There exist several definitions of financial literacy used by various scholars and state organizations. Financial literacy is defined as knowledge, ability or skills of applying this knowledge, knowledge in an individual's viewpoint, financial conduct, and financial experience. Rather often financial literacy is defined as a totality of particular dimensions focusing on various elements of the conception of financial literacy, for instance, money literacy, price literacy, budget literacy, or debt commitment literacy (Latvijas Banka, 2018; Latvijas Komercbanku Asociācija, 2018).

Financial literacy is a complex of knowledge and skills that make it possible for the population to understand and successfully organize their financial management and take responsible decisions as to the choice of different financial services and their use, providing for their private financial stability and sustainability (Latvijas apdrošinātāju asociācija, 2018). Financial skills constitute a set of knowledge and skills necessary for the financial self-provision of people and active involvement in the market of financial products and services (Skagerlund *et al.*, 2018.). The notion of financial literacy is defined in each bibliographical source in a different way, yet all of these definitions share a common meaning. Financial literacy entails both knowledge and skills necessary for everyone to make appropriate decisions in choosing financial products as well as rational planning one's personal budget and saving for emergency situations (Slovar bankovskih terminov, 2018). Good financial literacy knowledge is the basis for good choices of best financial offers and reaching wellbeing.

To obtain a common understanding of the notion of financial literacy, partners of financial and economic education promotion in Latvia have set a strategic vision of the preferable course of the development of Latvian society in the sphere of financial literacy. Since the agreement on the goals of financial literacy strategy for Latvian population for 2014 – 2020 and signing the Memorandum of its implementation on 24 February 2014, partners for financial literacy promotion in Latvia have provided various activities, elaborated new learning materials and interactive tools. Basic competence standard in financial literacy for adults is the first step towards a united lifelong education program in financial literacy in Latvia (Finanšu un kapitāla tirgus komisija, 2014). This

document is the first financial literacy competence standard in the Baltic countries that is based on the approach of the developed countries to the issues of society financial literacy improvement.

### 3. Studies of the financial literacy of young people in Europe and Latvia

Many countries of the world practise a regular assessment of their population's financial literacy. In several studies, testing knowledge in mathematics is a part of the instruments of testing, as ability of making mathematical calculations is one of the elements of financial literacy. If a person has weak knowledge in mathematics, she does not get involved into financial matters or does not choose the appropriate product due to inability of comparing the offers.

Based on the definition of OECD, financial literacy is assessed by regarding all four dimensions: 1) understanding and knowledge; 2) skills; 3) beliefs and attitudes; 4) conduct. Some scholars analyze all of these dimensions, others focus on them selectively. It depends on the research scope as well as the scholars' opinion of what makes financial literacy – knowledge, skills, perception, or all of these together. (Ciemleja *et al.*, 2013a; Ciemleja *et al.*, 2013b; Ciemleja, 2014).

The research “Financial Skills in Education” (Tomášková *et al.* 2011) executed in 2011 in Czech Republic shows that financially educated population are well aware of monetary and price issues and are capable of responsible management of their personal budget. Finances are an important part of everyday life and financial knowledge is the best way of averting excessive debt commitments of the population. According to the research outcomes, school learners do not obtain wide knowledge in the sphere of finances that would help them in future (Tomášková *et al.* 2011).

The research carried out in 2015 concludes that there are two main factors that affect child's experience in financial skills – those of family and school. Firstly, parents' financial socialization has a positive effect on the children's financial skills. Secondly, the impact of schools appears in the improvement of financial skills, calculation proficiency that is a basic skill. (Tomášková *et al.* 2015).

The research produced in 2018 (Skagerlund *et al.* 2018) concludes that the driving force of financial literacy is the ability of understanding numbers and avoiding emotional attitude to numbers that affects the individual's routine involvement in making decisions related to mathematics and finances. Hence, purposeful improvement of calculating proficiency may result in raising the financial literacy level in the society. The Financial and capital market commission as the national coordinator in the sphere of financial literacy promotion in Latvia has worked out a measurement system and its outcome summarizing methodology – index of financial literacy of population in Latvia.

The index includes the outcomes of annual sociological surveys, carried out by the Financial and capital market commission, of the financial literacy of the population or the positive score characterizing the overall financial literacy level of the population as well as the necessary statistical data characterizing the financial stability of Latvian households, their growth and sustainability.

Since 2014, the Financial and capital market commission has been carrying out annual surveys of the financial literacy of Latvian population, including OECD INFE financial literacy measuring base survey, in order to compare the financial literacy level among OECD states. The Financial and capital market commission organizes and coordinates communication with the society concerning the annual changes of this index (Finanšu un kapitāla tirgus komisija, 2015).



The financial literacy index comprises the overall outcome of the annual sociological survey of the population's financial literacy or the sum of positive/negative points in seven subjects of financial literacy that characterizes the overall financial literacy level in the particular year (Finanšu un kapitāla tirgus komisija, 2015). The financial literacy index is based on scoring points for respondents' particular replies. The overall score of the index oscillates from 76 to 99.

In order to execute complex assessment of financial literacy, certain criteria are needed. In this respect, for complex assessment of financial literacy it is very handy to use the research of the Financial and capital market commission "Financial Literacy of Latvian Population" where, to determine the Latvian population's financial literacy index, the knowledge of Latvian population concerning various financial services is assessed along with their application habits. As stated above, these research works are a valuable source for a complex assessment of financial literacy, and within this assessment it is essential to compare how these sub-indexes change.

### **3. Analysis of the formation of financial literacy of young people in Daugavpils**

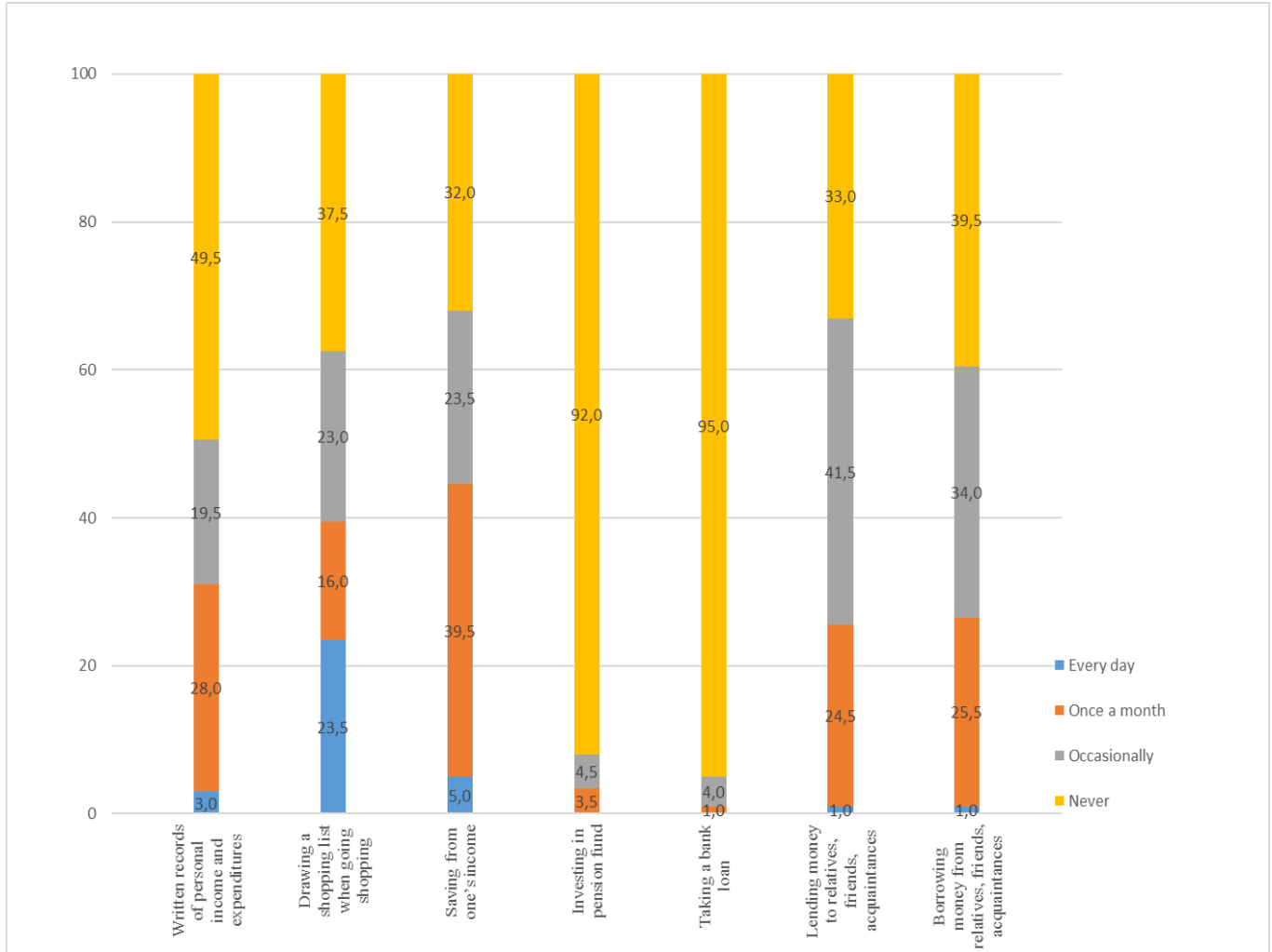
Although in literature and sources one can find several methods whereby scholars have tried to measure the financial literacy level, no unanimously best solution has been confirmed yet. It gives rise to rather serious limitations due to the fact that the research outcomes based on different methodologies are not comparable. Therefore, to avoid this situation, the authors of the present research chose to measure the financial literacy level among young people in Daugavpils by such methods that allow comparing the outcomes of research produced in other time and other place to those obtained within the present study, and vice versa – make this work comparable to other similar studies. Thus, in this case, to investigate the financial literacy of young people in Daugavpils the quantitative method of survey was selected. Within it the authors surveyed young people who study in Daugavpils to specify their financial literacy level.

To determine the financial literacy of young people in Daugavpils, the authors selected the uppermost indicators of financial literacy that are based on the definition of financial literacy as stated above. The selected indicators were such that register the involvement level of Latvian population in using financial services along with their knowledge and customary conduct in relation to various financial issues. The major indicators in the survey were chosen planning, awareness, financial services, and credits. The survey did not separately include such indicators as savings or pensions that are often essential indicators in sociological surveys of financial literacy, because in the given case they do not refer to the target audience of the research, yet they were synthesized within other issues. To a certain extent the selected indicators were based on the idea that financial literacy was directly related to the individual's awareness level of the basic issues of economy, financial conceptions and terms.

As concerns planning, especially important is the question where respondents have to state how often they carry out particular finance planning activities: written records of personal income and expenditure; drafting a shopping list when going shopping; saving from their income; investing in the pension fund; taking a loan in the bank; lending money to relatives, friends, acquaintances; borrowing money from relatives, friends, acquaintances. Financial planning is an essential component that includes knowledge on the principles of planning a private person's budget, knowledge on options of balancing incomes and expenditures, etc.

Being informed in practically any issue is a decisive aspect as lack of information may lead to ignorance. It concerns also financial literacy – lack of information may create disorientation and inability to plan and successfully use one's finances. Within the questionnaire, matching the target audience of the research, the authors attempted to clarify the respondents' awareness and experience with financial products. Knowledge of the products and services offered by banks and other financial institutions is essential for understanding risks and liabilities that arise when dealing with more complex financial products, etc. It is equally important to acknowledge not only the awareness level of these financial services but also their practical use (see Fig.1).





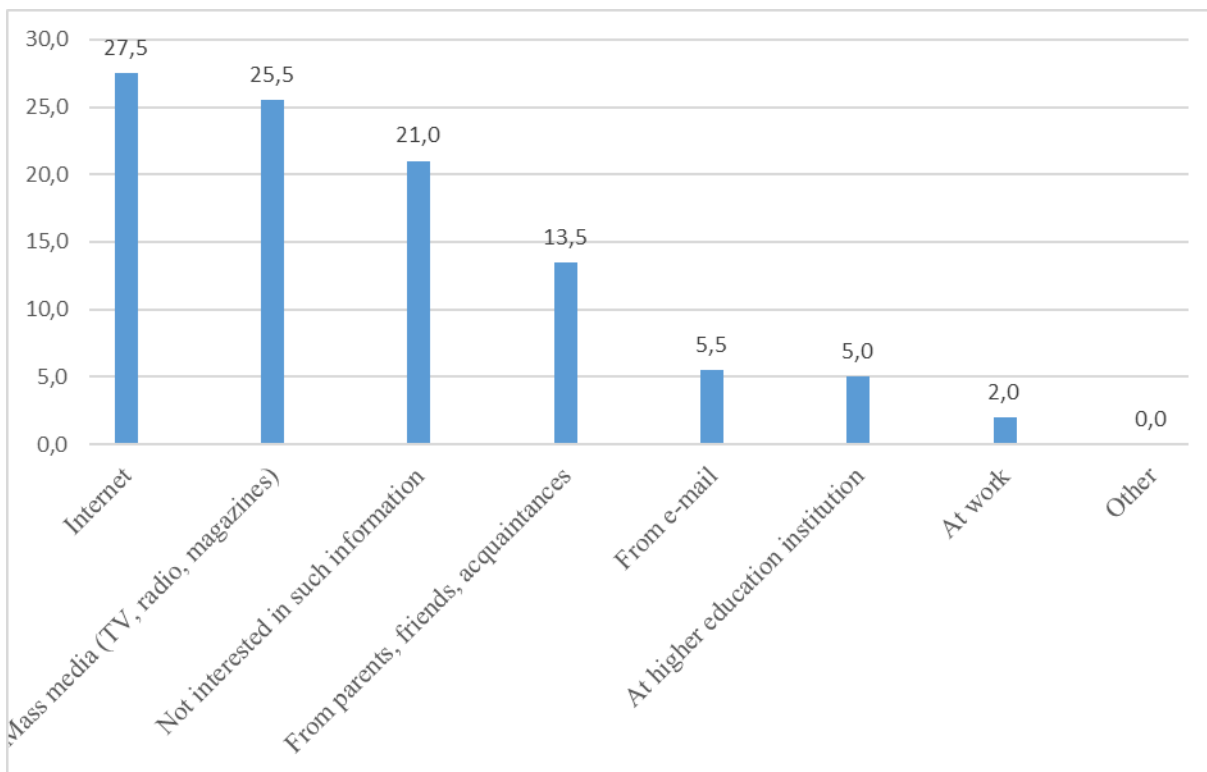
**Fig.1.** Activities of financial planning by young people who study in Daugavpils  
(% from the total number of replies)

*Source:* author's calculations on the basis of the survey on young people studying in Daugavpils, 2017

Awareness of virtually any issue tends to be a decisive aspect, whereas a lack of information or awareness tends to lead to ignorance. It also refers to financial literacy – a lack of information might result in disorientation and inability to plan and make good use of one's finances. Within the framework of the questionnaire intended for the study of the target audience, there was an attempt to find out the

respondents' awareness of financial products and their interaction with them. Knowledge about products and services offered by banks and other financial institutions is crucial for the understanding of risks and commitments that arise when people have to deal with more complicated financial products, etc. It is also important to understand not only the level of awareness of these financial services, but also their practical application.

In order to study the information about financial literacy and young people's aspirations to acquire advanced knowledge in this sphere, it is necessary to find out where they most frequently obtain information about financial issues, the extent to which the necessary knowledge in the financial field is acquired at university, if young people have a desire to develop and improve their knowledge of financial literacy, as well as what additional knowledge of financial literacy they would like to acquire (see Fig.2).

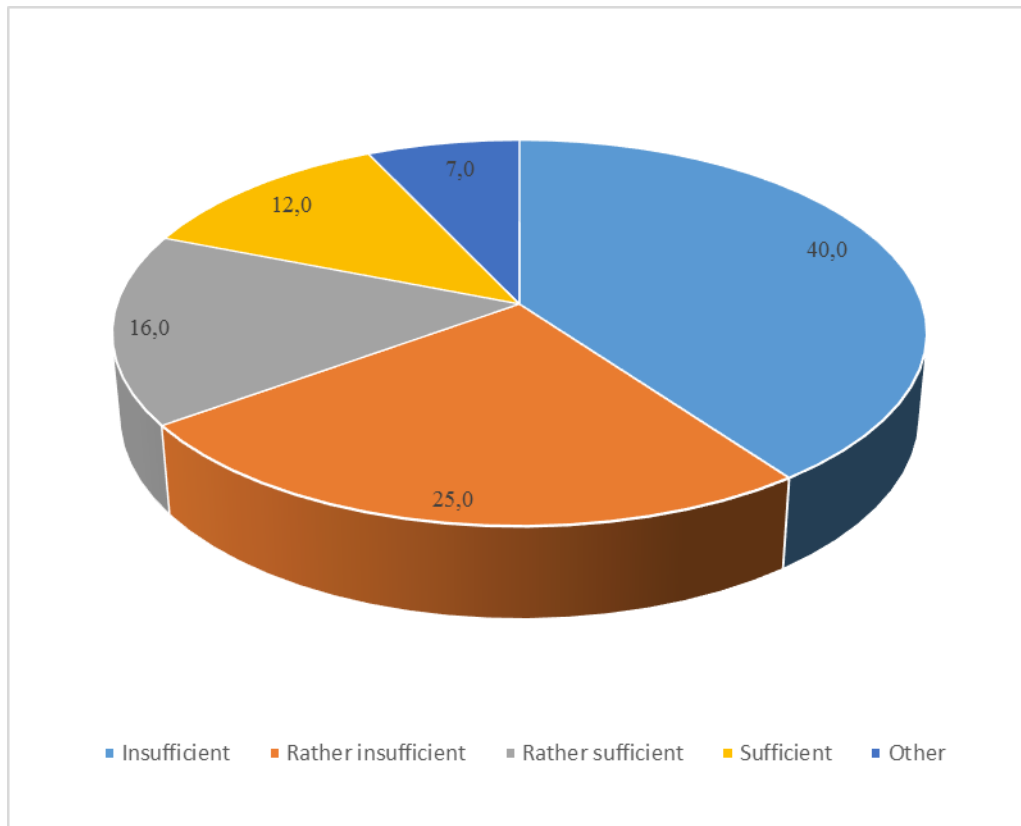


**Fig.2.** The way respondents obtain information on financial issues (% from the total number of replies)

*Source:* author's calculations on the basis of the survey on young people studying in Daugavpils, 2017

To study the situation with the circulation of information on financial literacy and young people's wish to obtain in-depth knowledge, it is necessary to clarify where the information on financial issues is most often gained, to what extent the knowledge in the sphere of finance is obtained in higher education, whether young people wish to expand their financial literacy knowledge, also what knowledge exactly they wish to learn.

These questions help bringing out the most efficient information media in financial literacy issues, how efficient is the information available at education institutions, what aspects are in need of greater awareness. Finally, these indicators help determining the level of interest of young people in financial literacy.



**Fig.3.** Students' opinion on whether higher education provides sufficient knowledge on financial issues (% from the total number of replies)  
*Source:* author's calculations on the basis of the survey on young people studying in Daugavpils, 2017

As covering tuition fees is often an essential issue among young students, credits and credit obligations constitute another significant financial literacy indicator. Consequently, it is important not only to clarify whether respondents have concrete credit obligations but also their opinion as to what debt commitment they are ready to assume and what monthly payment they would be able to cover. As at the beginning of the survey the respondents' monthly income is specified in terms of salary, grant, benefit, questions about credit obligations reveal to what extent respondents are aware of their capability to assume credit obligations. Skill of making information-based decisions is one of the most important financial literacy components. Debt obligation literacy that characterizes an individual's or a household's knowledge and skills in credit obligation management include skills of calculating interest, understand the credit repayment schedules, etc.

In 2017 a survey of young people studying in Daugavpils was carried out. The target group or the sampling general set of the survey entails all students of Daugavpils higher education institutions and their subsidiaries aged from 18 to 25. The number of students in Daugavpils in the age group from 18 to 25 is 1711. Data concerning the number of young students were obtained from six higher education institutions and their subsidiaries that are in Daugavpils.

The sampling value is calculated by the following formula (1) (Orlovska, 2007)

$$n = \frac{t^2 * S^2 * N}{t^2 * S^2 + \Delta_x^2 * N}; (1)$$

wherein:

N- the volume of the general totality,

t- probability factor,

S<sup>2</sup>- sampling dispersion,

Δ<sub>x</sub> – permissible limiting error.

The sampling parameters of the survey are as follows:

t = 1.96, as the reliability of outcomes will make 95%,

S<sup>2</sup> = 0.25, as the part of the studied feature in the general set is not known,

Δ<sub>x</sub> = 0.05, as the maximum permissible value of the sampling error will make 5%.

$$n = \frac{1,96^2 * 0,25 * 1711}{1,96^2 * 0,25 + 0,05^2 * 1711} = 314 \text{ students}$$

The ideal volume of sampling would be 314 respondents, yet only 200 respondents participated in the survey. Hence, the possible error will be bigger.

To assess the reliability of the obtained survey data, the probability of the limiting error is used. The limiting error is calculated mathematically on the basis of theory of probability. It ought to be taken into consideration when analyzing and interpreting the research outcomes.

The limiting error is calculated by the following formula (1.) (Orlovska, 2007):

$$\Delta w = t * \sqrt{\frac{w(1-w)}{n} * (1 - \frac{n}{N})} (2)$$

wherein:

Δ<sub>w</sub> – limiting error,

t- coefficient, that with 95% of probability equals 1.96,

w – relative frequency in the sampling (part of sampling),

n- number of respondents,

N- volume of the general totality.

The limiting error is determined on the basis of unweighted number of respondents in the respective group and the sampling part. Using these values one may find the limits of the limiting error + / - interest with 95% probability.

**Table 1.** Respondent replies to the question: “How would you assess your financial literacy?” (%)

I am very well informed of the financial matters	6.5
I am well informed	58
I am poorly informed	27
I am very poorly informed	8
Other	0.5

Source: table created by the authors based on the survey outcomes

Using the data obtained from the respondents, the statistical error can be calculated (3):

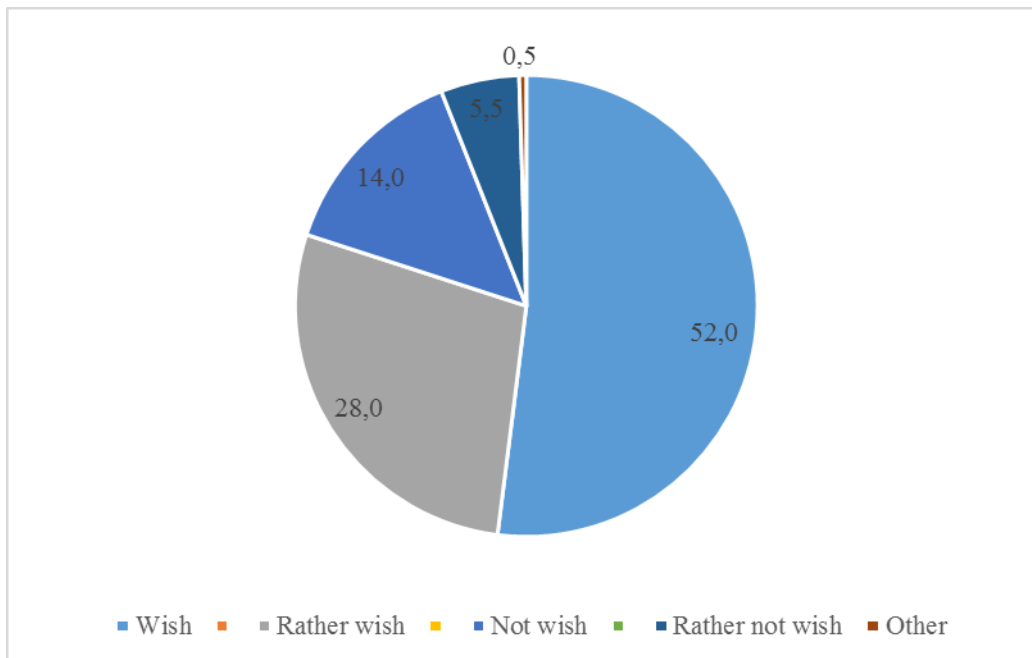
$$\Delta w = 1,96 * \sqrt{\frac{0,065 (1-0,065)}{200} * (1 - \frac{200}{1711})} = 0,032 = 3,2\% \quad (3)$$

Hence, if all the surveyed young students in Daugavpils (number of respondents n=200) yield a target group making 6.5% who are very well informed of financial matters, then it may be stated with 95% probability that the statistical error is in the limits of  $\pm 3.2\%$ .

According to the survey data, the young people who admitted being very well informed of financial matters are not informed of such financial products as accumulative life insurance (61.5%), 3rd pension level (46.15%), long-term credit (46.15%), short-term credit (46.15%), as well as savings account (46.15%), and mortgage credit (38.46%).

In turn, those young people who replied that they are well informed of financial matters, are not informed of the following financial products: accumulative life insurance (64.65%), long-term credit (35.34%), short-term credit (34.48%), as well as mortgage credit (31.9%) and 3rd pension level (29.3%).

The authors hold that those young people who admit being very well or well informed of financial matters ought to be aware of such basic issues as various types of credit, savings account, and accumulative life insurance. Thus, it may be concluded that the majority of young people who participated in the research have inadequately high assessment of their financial literacy, and their knowledge in this sphere is not as good as they consider it to be. The survey outcomes within the research reveal that the financial literacy knowledge of young people studying in Daugavpils needs to be improved.



**Fig.4.** Respondents' wish to improve their financial literacy knowledge (% from the total number of replies)

*Source:* author's calculations on the basis of the survey on young people studying in Daugavpils, 2017

In each matter, the individual's wish and motivation for improvement and gaining new knowledge are of primary importance. Hence, the assessment of the respondents' wish for improving their financial literacy knowledge reveals that only 52% of them wish to improve their knowledge, 28% replied that they would rather wish to

improve their knowledge, whereas 14% replied that they would not wish to improve their knowledge in financial matters. As it is stated that 21% of respondents are not interested in financial matters at all, such outcomes are natural. It may be assumed that, among those 14% who do not wish to improve their financial literacy knowledge, there are such persons who already hold very good knowledge, yet the question about the use of various financial instruments revealed that this knowledge for a large part of respondents was insufficient. In this respect, the problematic aspect might be not so much the lack of information as lack of interest in learning more about these issues and lack of students' initiative (see Fig.4).

## Conclusions

Young people who study need more awareness of various financial instruments that are developing fast under the present-day conditions of changing market, as its lack aggravates decision-making.

Education policy makers along with higher education institutions need to unite for elaborating a common, coordinated, and many-sided action for the implementation of financial literacy promotion measures.

Higher education institutions need to cooperate with public opinion research agencies that would help locating the financial aspects wherein young people lack information most of all, thus working out new initiatives that would not be of general character but oriented at concrete financial aspects.

The Ministry of Education and Science, the Ministry of Finance as well as local governments should improve their cooperation in order to ensure accessibility of additional information about financial literacy. The Ministry of Education and Science could design the standard of financial literacy for school learners, indicating the competences in the field of finance they need to obtain. The Ministry of Education and Science in cooperation with Education administrations could provide teachers with methodological support for educating learners about financial literacy. Education administrations could ensure e-support in learning and acquisition of knowledge in the field of finances. The Ministry of Finance in cooperation with the Ministry of Education and Science could organize financial literacy contests for young people.

## References:

- Botric, V.; Bozic, L. 2017. Access To Finance: Innovative Firms' perceptions In Post-Transition EU MEMBERS. *E+ M Ekonomie a Management*, 20(1), 129. <https://doi.org/10.15240/tul/001/2017-1-009>
- Ciemleja, G.; Lace, N.; Titko, J. 2014. Financial literacy as a prerequisite for citizens' economic security: development of a measurement instrument, *Journal of Security and Sustainability Issues* 4(1): 29–40. DOI: [http://dx.doi.org/10.9770/jssi.2014.4.1\(3\)](http://dx.doi.org/10.9770/jssi.2014.4.1(3))
- Ciemleja, G.; Lāce, N.; Titko, J. 2013a. Personīgo finanšu pārvaldība. [Management of personal finance]. Rīga: RTU.
- Ciemleja, G.; Lāce, N.; Titko, J. 2013b. Finanšu lietpratība un tās novērtēšana. [Financial literacy and its evaluation]. Rīga: RTU.
- Fabuš, M. 2017. Current development of business environment in Slovakia and Czech Republic, *Entrepreneurship and Sustainability Issues* 5(1): 127-137. [https://doi.org/10.9770/jesi.2017.5.1\(10\)](https://doi.org/10.9770/jesi.2017.5.1(10))
- Finanšu un kapitāla tirgus komisija. 2014. Latvijas iedzīvotāju finanšu prātības stratēģija 2014-2020. [Financial literacy strategies of Latvian population]. Available on the Internet: [http://www.fktk.lv/texts\\_files/Strategijas\\_makets\\_final.pdf](http://www.fktk.lv/texts_files/Strategijas_makets_final.pdf)
- Finanšu un kapitāla tirgus komisija. 2015. Finanšu prātības indekss. [Financial literacy index]. Available on the Internet: <http://www.fktk.lv/lv/publikacijas/pazinojumi-masu-informacijas-l/2015/5192-fktk-latvijas-iedzivotaju-finansu-pratiba-pakapeniski-pieaug.html>

Finanšu un kapitāla tirgus komisija. 2017. Pamata kompetences finanšu pratībā pieaugušajiem. [Basic competencies in financial literacy for adults]. Available on the Internet: [http://www.fktk.lv/attachments/article/6220/STANDARTS\\_FINAL\\_222032017.pdf](http://www.fktk.lv/attachments/article/6220/STANDARTS_FINAL_222032017.pdf)

Grohmann, A.; Kouwenberg, R.; Menkhoff, L. 2015. Childhood roots of financial literacy, *Journal of Economic Psychology* 51: 114-133. <https://doi.org/10.1016/j.joepe.2015.09.002>

Illmeyer, M.; Grosch, D.; Kittler, M.; Pamela Priess. P. 2017. The impact of financial management on innovation, *Entrepreneurship and Sustainability Issues* 5(1): 58-71. [http://doi.org/10.9770/jesi.2017.5.1\(5\)](http://doi.org/10.9770/jesi.2017.5.1(5))

Kozubikova, L.; Homolka, L.; Kristalas, D. 2017. The effect of business environment and entrepreneurs' gender on perception of financial risk in the smes sector, *Journal of Competitiveness* 9(1): 36 – 50. <https://doi.org/10.7441/joc.2017.01.03>

Latvijas apdrošinātāju asociācija. 2018. Finanšu pratība. [Financial literacy]. Available on the Internet: <http://www.laa.lv/klientiem/finansu-pratiba/>.

Latvijas Banka. 2018. Statistikā lietotie jēdzieni. [Definitions used in statistics]. Available on the Internet: <https://www.bank.lv/statistika/informacija-statistikas-lietotajiem/statistika-lietotie-jedzieni?pop=1&tmpl=component>

Latvijas Komercbanku Asociācija. 2018. Finanšu pratība. [Finanšu pratība]. Available on the Internet: <http://lka.org.lv/lv/finansu-pratiba/>  
Latvijas Universitātes Antropoloģijas studiju katedra. 2012. Jauniešu finanšu lietpratība. [Financial literacy of young people]. Available on the Internet: [https://www.antropologija.lu.lv/fileadmin/user\\_upload/lu\\_portal/projekti/antropologija/finansu\\_lietpratiba.pdf](https://www.antropologija.lu.lv/fileadmin/user_upload/lu_portal/projekti/antropologija/finansu_lietpratiba.pdf)

Latvijas Universitātes. 2017. Latvija. Pārskats par tautas attīstību 2015/2016. Dzīves meistarība un informācijpratība. [Mastery of life and information literacy]. Galv. red. Baiba Holma. 152 lpp. ISBN 978-9934-18-240-2

Laužikas, M.; Miliūtė, A.; Tranavičius, L.; Kičiatovas, E. 2016. Service Innovation Commercialization Factors in the Fast Food Industry, *Entrepreneurship and Sustainability Issues*, 4(2): 108-128 [http://doi.org/10.9770/jesi.2016.4.2\(1\)](http://doi.org/10.9770/jesi.2016.4.2(1))

Michailova, J.; Mačiulis, A.; Tvaronavičienė, M. 2017. Overconfidence, risk aversion and individual financial decisions in experimental asset markets, *Economic research = Ekonomska istraživanja*. Pula: Taylor & Francis. ISSN 1331-677X, 30(1): 1119-1131. <http://dx.doi.org/10.1080/1331677X.2017.1311234>

Njaramba, J.; Chigeza, P.; Whitehouse, H. 2015. Financial literacy: the case of migrant African-Australian women entrepreneurs in the cairns region, *Entrepreneurship and Sustainability Issues* 3(2):198-208. DOI: [http://dx.doi.org/10.9770/jesi.2015.3.2\(7\)](http://dx.doi.org/10.9770/jesi.2015.3.2(7))

OECD. 2014. PISA 2012 Results: Students and Money Financial Literacy Skills for the 21st CENTURY Volume VI. Available on the Internet: <http://www.oecd.org/pisa/keyfindings/PISA-2012-results-volume-vi.pdf>

Ohotina, A.; Lavrinenko, O.; Gladevich, J.; Lazdans, D. 2018 b. The investment climate in Latvia's, Lithuania's and Belarus's cross-border regions: the subjective-objective assessment, *Entrepreneurship and Sustainability Issues* 6(2): 767-780. [http://doi.org/10.9770/jesi.2018.6.2\(20\)](http://doi.org/10.9770/jesi.2018.6.2(20))

Ohotina, A.; Lavrinenko, O.; Ignatjeva, S.; Lonska, J. 2018 a. Socio-economic security as a determinant of regional differences in the investment climate in the region, *Journal of Security and Sustainability Issues* 7(3): 427-438. [https://doi.org/10.9770/jssi.2018.7.3\(5\)](https://doi.org/10.9770/jssi.2018.7.3(5))

Orlovska, A. 2007. Statistika: mācību līdzeklis. [Statistics: training tool]. Rīga, Rīgas Tehniskā universitāte.

Organisation for Economic Co-operation and Development. 2014. New approaches to SME and entrepreneurship financing: Broadening the range of instruments. OECD report to G20 finance ministers and Central Bank governors. Retrieved from <http://www.oecd.org/cfe/smes/New-Approaches-SME-synthesis.pdf>

Organisation for Economic Co-operation and Development. 2015. Toolkit for measuring financial literacy and financial inclusion. Available on the Internet: [https://www.oecd.org/daf/fin/financial-education/2015\\_OECD\\_INFE\\_Toolkit\\_Measuring\\_Financial\\_Literacy.pdf](https://www.oecd.org/daf/fin/financial-education/2015_OECD_INFE_Toolkit_Measuring_Financial_Literacy.pdf)

Skagerlund, K.; Lind, T.; Strömbäck, C.; Tinghög, G.; Västfjäll, D. 2018. Financial literacy and the role of numeracy—How individuals' attitude and affinity with numbers influence financial literacy, *Journal of Behavioral and Experimental Economics (formerly The Journal of Socio-Economics)* 74(C): 18-25. <https://doi.org/10.1016/j.socec.2018.03.004>



Slovar bankovskih terminov. 2018. Finansovaya gramotnost. [Financial literacy]. Available on the Internet: [http://www.banki.ru/wikibank/finansovaya\\_gramotnost/](http://www.banki.ru/wikibank/finansovaya_gramotnost/)

Tomášková H., Mohelská H., Němcová Z. 2011. Issues of Financial Literacy Education. Procedia - Social and Behavioral Sciences.: <https://doi.org/10.1016/j.sbspro.2011.11.069>

Tomášková H., Mohelská H., Němcová Z. 2015. Childhood Roots of Financial Literacy. Issues of Financial Literacy Education. Abstract of research paper on Economics and business.

Yin, R.K. 2003. Case Study Research: Design and Methods. New Delhi: Sage Publications.

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## TRANSFORMATIONAL COMMUNICATION VIA EVOLVING ETHICAL AND MORAL NORMS OF LITHUANIAN CIVIL SERVICE ORGANIZATIONS

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**Abstract.** A holistic approach to transformational communication (examined from the perspective of ethical and moral norms) requires investigation of its different aspects, such as communication efficiency (Paynton et al, 2016), evolution of ethics (Bud'urova, 2015), business ethics (Boatright, 2011; Norman, 2013, and etc.), transformational leadership (Uusi-Kakkuri, 2017; Jiang et al., 2017, and etc.), social capital (Growiec et al., 2017; Grieco, 2017, and etc.) or more specifically, ethical and moral norms (Orozco-Toro and Ferré-Pavía, 2013; García-Marzá, 2017). Such multi-facet interpretation of transformation communication explains various effects of communication which are experienced by any economy or organization undergoing reforms, transition from one development category to another or trying to enhance performance and reach sustainability while facing new global trends (related to networking, new technologies, innovation, knowledge sharing as well as bigger pressure from stakeholders to generate social value-added). Being more visible and closer to citizens, civil service organizations face the necessity to apply innovative communication means and collaboration-based approach to policy implementation, whilst many jeopardizing factors, such as insufficient social trust, the fear of failure, bureaucracy or lack of consistency, diversity and reward, call for implementation of various communication guidelines and ethical and moral norms-related documents. Thus, **the research question** “How to leverage the potential of transformational communication via ethical and moral norms in civil service organizations” is particularly relevant among economies which still face frequent manifestations of nepotism or fragile social trust dimensions. To avoid of triviality and to have a more profound analysis of the topic, the research is anchored in qualitative methodology, where results of **semi-structured interviews** with 20 Lithuanian civil servants support the designed conceptual model of transformational communication effects, which serves as a practical and useful education tool for policy makers and civil servants.

**Keywords:** transformational communication, evolving ethical and moral norms, leadership, civil service organizations.

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## **1. Introduction**

The Literature on Communication Efficiency is well established: communication experts Paynton et al (2016) overview the scientific publications throughout various periods, backing to the forties (Hovland, 1948; Morris, 1946; Nilsen, 1957; Schramm, 1946; Stevens, 1950). In spite of a long list of definitions of communication as well as classifications of its types and channels during the decades, the core fundamentals of communication remain the same. According to Paynton et al (2016), communication is the use of symbols to reveal the meaning/ essence. While shifting from linear/ mathematical to more transactional/ interactive type of communication, communication imbeds social value-added and positive externalities as well as affects social trust, attitude and perception of employees, stakeholders and society overall. Such evolution trends could be identified within positive practices of innovation-driven countries, such as Canada (TakingITGlobal, managed by Walraven, 2008) or the UK (Government Communication Service, the UK 2017), where communication (driven by innovation and social value-added via engagement of employees, society and community-building) is more long-term target; however, civil service organizations must be ready for the change, as modern technologies make their work more transparent, dynamic, because it is collaboration and knowledge-driven. Such transformation also calls for new social and cultural pillars, in particular, in the area of ethical and moral norms: being more interactive with stakeholders' civil service organizations face the necessity to embrace a set of new requirements, such as tolerating mistakes and learning from the past experience, social trust and evolving moral and ethical standards. As it is discussed by Bud'urova (2015), fact/value dichotomy is not so sharp in the context of evolutionary ethics which might justify morality on the basis of facts, while evolutionary theories (which might be not so value-free) should be interpreted with cautiousness and context-based.

From the business ethics point of view, Norman (2013) admits that evolution of ethics in business takes gradual steps and could be witnessed via continuous modification of classical paradigm of business ethics within scientific literature. While overviewing various scholars (such as Donaldson and Dunfee 1999; Heath 2006; Boatright 2011), Norman comes to conclusion that, apart from tackling the questions how individuals in business ought to behave, or what principles they might appeal, business ethics in the broadest sense address a rather vast spectrum of challenges and designs for firms, markets, regulations, and political oversight. According to Norman (2013) these specific challenges are interpreted in the context of micro-level virtue ethics, mid-level stakeholder theories, or macro-level theories of corporate social responsibility. Thus, business ethics is centred on continuous evolution of values, principles and standards which are in line with rapidly changing business and political environment as well as different trends across various industries and policies.

## **2. Transformational Communication as Leadership**

Transformational communication is often interpreted in the context of transformational leadership. For instance, Uusi-Kakkuri (2017) in the dissertation "Transformational Leadership and Leading Creativity" argues that transformational leadership is an appropriate style for creative people, because intellectual stimulation and inspirational motivation help lead creative individuals and innovators. Transformational leadership is a popular and rapidly evolving scientific area worldwide: Jiang et al. (2017) interpret transformational leadership in the context of employees' motivation and their performance (it has positive influence on employees' sustainable performance in Chinese construction project); Aunjum et al. (2017) estimated that transformational leadership had positive and significant impact on employee motivation in the Banking sector of Pakistan, and it should be achieved via transformational and charismatic leadership.

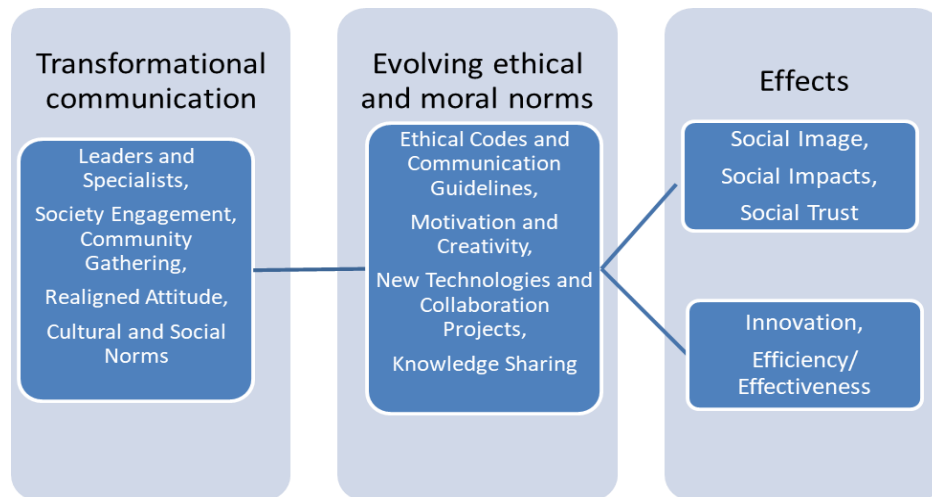
Within the report prepared jointly by the World Bank and the African Development Bank in cooperation with the African Union, Yonazi et al. (2012) emphasize the role of transformational communication in the context of society and stakeholders' transformation via modern technologies or technological competences of entrepreneurs and leaders. While focusing on Spanish local governments, Gálvez-Rodríguez et al. (2016) emphasize the role of Internet and community managers in engaging citizens, because community managers do not use social media efficiently to link local governments and citizens. Furthermore, positive experiences of more advanced innovation-driven economies, such as the UK, should be taken into consideration while engaging society and creating community spirit in various development areas. As for example, Science and Technology Committee, authorized by House of Commons of the UK (2017), encourage society engagement in science-related policies: public opinion should be fully captured in developing government policy where science is involved. Such practices can be applied in efficiency-driven countries or other areas of public administration; however, the context of cultural and social norms, social trust, knowledge diffusion, communication style, and many other social capital dimensions should be taken into account.

### 3. Transformational Communication within Social Capital Dimensions

Acknowledgment of the environment as part of social and cultural context was accentuated by many scholars. Fang et al. (2017) in their research tried to examine effects of normative beliefs, social norms and attitudes on behavioral intentions (research related to reusable tableware at theme park in Taiwan). The authors found out that c.a. one fifth of 391 respondents possessed pro-environmental behaviors, while the rest of interrogated respondents were significantly affected by social environmental education, which reveals the significance of education in transforming society via knowledge and inspiration.

Camargo and Passas (2017) within their paper presented during OECD Global Anti-Corruption & Integrity Forum, address the specificity of cultural and social environment in the context of corruption: adoption of best anticorruption practices worldwide in some countries might be inefficient, for instance in Africa, Central Asia and the Caucasus, which could be associated with discrepancy between formal rules and informal practices. While interpreting the power of transformational ethics on citizens, the authors explain the social acceptability of corrupt acts by citizens' orientation to tactical, more practical, informal and short-term benefits, as well as a rather fragmented value created by public administration organizations. From this perspective, integration of informal practices and society engagement techniques into anti-corruption strategies or official policies could contribute to more sustainable and effective decisions, and, in parallel, stronger social image of civil service organizations.

Within the social capital structure, examined by Growiec et al. (2017), network degree (number of social ties), network centrality (bridges among otherwise disconnected sub-networks), bridging (social ties among dissimilar others), and bonding social capital (social ties among similar others) are anchored in the context of social trust and willingness to co-operate. According to authors, these network dimensions are strongly and positively linked to individual incomes; while social individuals' life satisfaction is determined primarily by the number of social ties an individual holds (network degree). Given the growing importance of collaboration, communication efficiency (which in the conceptual model, developed by the par author, refers to society engagement, community gathering, and creative leadership and specialists) is critical, because it leads to reshaped dimensions of social capital and realigned attitudes to current globalization context (see Figure 1). From the perspective of stronger ties among stakeholders, evolving ethical and moral norms call for modern technologies and practical communication tools enabling knowledge sharing and creativity enhancement. The conceptual model introduces a set of effects, which a modern organization is eager to reach, if effective transformational communication-related decisions are taken.



**Fig. 1.** The Conceptual Model of Transformational Communication Effects

*Source:* prepared by paper author

Grieco (2017) reveals similar arguments regarding impacts of social capital while emphasizing the element of partnerships, which is directly related to communication and serves as a tool for strategy development: it should broaden relationships between employees and partners; moreover, all social capital dimensions (cognitive, relational, structural/ network-based) positively influence the innovation capability. On the other hand, citizens and other stakeholders, driven by modern technologies, require more transparency, engagement, knowledge sharing and shared-value creation (which are directly related to different social capital dimensions, such as social trust, fear of failure or opportunity recognition).

#### 4. The Role of Ethical and Social Norms in Transformational Communication

To better understand the context of communication (oriented to transformation and value/ attitude alignment as well as society engagement) it is important to identify the main effects and reinforcement principles of ethical and social norms. García-Marzá (2017) introduces the model of 'Ethical Auditing', which links three elements: perception, verification and adequacy. According to the author, insufficient compliance between commitments and regulated conduct, both at planning and execution stages, emerge as a barrier to creating social value-added (thus, affects communication of the information regarding social responsibility in organizations, which, in parallel, influences attitude, perception and social image).

García-Marzá (2017) adds that ethics of communication might be used as the basis to develop mechanisms of transparency and participation, which is essence of transformational communication. The author underlines 4 elements, which are necessary to reinforce the ethics of communication: ethical code of conduct, social responsibility reports, ethics committee, and ethics hotline (alerts and complains system). Given the lack of transparency in public administration organizations, due to insufficient sustainability and poor society engagement, ethical audit should be external to organizations and help seek consensus among various stakeholders (Sorsa, 2008; Orozco-Toro and Ferré-Pavía, 2013).

In light of technological innovation and emerging artificial intelligence, communication cannot be interpreted only in the context of human capital. Apart from formalized and communicated values in professional codes of ethics (which often implies machine-type ethical reasoning, knowledge development, and decision-making): Otterlo (2017) emphasizes that legal ways of formalizing behavior and communication might be too slow,

compared to technological innovation; therefore, ethical codes as guidelines are more popular. Many authors, who were analyzed by Otterlo (2017), believed that it was possible to efficiently link technology with ethical codes if artificial intelligence was more responsible or accountable (Diakopoulos 2016; Etzioni and Etzioni, 2016), and private information was protected (Tene and Polonetsky, 2014; Tvaronavičienė 2018; Davidavičienė et al., 2019).

Furthermore, many civil service organizations try to encourage creativity and improve transparency; the lack of transparency, particularly in decision-making, is a key challenge among public administration organizations. Continuous learning and new knowledge application in technology might help obey human values and norms (Abel et al 2016) and reshape values and principles (Taylor et al. 2017). Although it is difficult to cover a rich variety of complex knowledge domains by technology, due to tacitness of knowledge, Otterlo (2017) suggests formalizing present fundamentals of ethical codes via suitable computational logics, which could make ethical and moral norms-related communication more value-adding, engaging, and efficient.

Given a complex transformation experience from centrally planned Soviet Innovation Systems to holistic knowledge-driven innovation system, many CEEC countries, such as Lithuania, possess insufficient social trust; thus, transformational leadership and communication are offset by the fear of failure, uncertainty avoidance, and lack of trust (Laužikas and Dailydaitė, 2015). Moreover, various stakeholders (civil service organizations, private companies, customers/ clients, information centers or education institutions, R&D transfer organizations, and citizens) need communication facilitators or community spirit building tools. Weak risk management and strategic planning competencies along with uncertainty avoidance diminish the innovation progress in those economies; thus, society engagement via new technologies and the time of changes is critical.

## **5. Methodology**

Ethical and moral norms, organizational philosophy, values and principles are fundamentals to communication efficiency during the time of change: these factors are inter-connected and manifest as the main drivers of transformational communication, which might lead to society engagement, community building and stronger social image (Curristine et al, 2007). These effects are particularly important to civil service organizations, as they are centred on social value-added and liaisons between political priorities and strategies. Moreover, ethical codes and behavior guidelines refer to the social capital dimensions, and, to be more precise, to communication plans during the time of change, future communication strategies as well as communication descriptions of various job positions (it affects employee motivation, creativity, combination of employees' and organizational expectations as well as performance efficiency and sustainability within a network of diverse stakeholders) (Government Communication Service, the UK 2017).

Having scientific literature analysis results summarized in the conceptual model of Transformational Communication Effects, the semi-structured qualitative expert interviews with 20 civil service specialists from Lithuanian civil service is chosen to better understand the transformational communication challenges and opportunities ethical and moral norms could bring to public administration organizations in Lithuania, along with the reasons and tactics of choosing a particular communication type or strategy.

Based on the developed conceptual model, the semi-structured questionnaire contained a few blocks of questions, related to: communication during the time of change, communication enhancement techniques, the role of Human Resource Management within communication processes, innovation and creativity as well as the potential effects of ethical and moral norms. The valid responses from 20 experts were received on the 5th December 2017, and all the respondents accorded to 3 main criteria in terms of: experience, education and their relation to the Communication area.



After ingenious analysis of research results, the conceptual model was backed by experts' insights and the transformational communication model was adjusted in order to provide pertinent recommendations for civil service organization in Central and Eastern European Countries. Civil service organizations are recommended to use the revised model while valuating effects of transformational communication before and after the ethical codes and communication guidelines were introduced (both in the shorter and longer run), while applying a set of concrete measures in line with their organizational context. The present publication could serve as a reference to further research, focused more on indicators representing effects of transformational communication.

## **6. Research Results: Sustainability through Evolving Ethics and Communication**

In light of emerging significance of social value-added and bigger attention to positive externalities across various types and status organizations, experts of Lithuanian civil service organizations also address these new trends while emphasizing social impacts and ethical/ moral communication within networks. An efficient ethical code might serve as non-financial motivation means while encouraging various social innovation and value-adding activities; in parallel, it affects employee turnover and main career drivers: four experts agreed that ethical and moral norms might be among the most important reasons for career choice or resigning from public administration organizations. One expert, representing younger and less experienced civil servants, emphasized that non-financial remuneration was not adequate to efforts of getting a civil service job and demonstrating efficient performance to stakeholders. Apart from small wages, the expert did not find work activities as corresponding to his/ her job position and qualifications along with unequal assessment of employees' performance due to subjective reasons and nepotism, in addition to conservatism and lack of innovation (all these areas could be improved thanks to ethical codes, which could affect employee turnover and satisfaction).

The most of the experts admitted that management style and personality might endanger social trust, respect and satisfaction among employees; it is particularly acknowledged during the time of management change. As for example, one Head of ministry department invited to his/ her team to demonstrate how positive attitude and smooth communication between managers and employees might affect the psychological climate and innovation culture of the department via an ethical code. Another more experienced expert emphasized the role of self-esteem and pride which should be encouraged via ethical codes, as civil servants might feel the lack of support and confidence from society along with insufficient financial reward.

As it could be expected, younger experts with modest experience in civil service underlined another important function of ethical codes, which is a guideline in building and managing teams: competences, attitude and commitment should be more important than nepotism; initiatives and creative leaders should be supported; listening and empathy-based communication should be established, while political priorities should not hide misbehavior and breach of ethical and moral norms. However, there were experts who could not acknowledge team-building and team-management manifestations at all, which eliminated the possibility to discuss regarding the role of creative, talented and innovative teams. Five experts suggested that ethical codes were necessary in civil service, but they should be implemented in a more employee-friendly and natural way. One expert suggested 10 recommendations' format while avoiding strict rules and legal aspects, while another specialist emphasized self-discipline and authority-based, yet explicit code; only one respondent underlined communication of ethical principles and norms (along with implementation) among employees: there should be no excuse to unethical behavior, and employees should encourage each other to be moral and ethical.

The fragmented and rather conservative approach to ethical codes was illustrated by the fact that no one among experts emphasized flexibility and sustainability-related aspects, such as the role of ethical codes during the time of change, communication of strategic targets, internal communication, opportunities of strengthening social image and encouraging creativity, as well as innovation and modern technologies. Such result shows that civil

servants do not have sufficient experience and knowledge regarding impacts and implementation possibilities of ethical codes.

Having rather limited knowledge on ethical and social norms and incapability to identify innovative ways to engage society and build community, civil service organizations should strengthen their strategic collaboration in all the weaker areas. Joining associations, digital networks, startup ecosystems, entrepreneurship research centers, clusters and associations of various industries, as well as entering into co-operation agreements with new Lithuanian and international partners could elevate communication efficiency to a higher level via common events, projects, research, and knowledge sharing. This will affect cost structure, image, internationalization level, synergy effects, society, stakeholders' satisfaction, and social trust. Nowadays, it is not necessary to attend various projects physically: many activities are carried out online or via mobile technologies (in particular the dissemination part of projects and activities).

Notwithstanding the importance of strategic partnerships in communication during the time of change, only one expert emphasized the role of external consultants while communicating among different-level civil servants during the time of change. As it was expected this expert represented the younger group of civil service experts. Given modest team-management competences, two experts mentioned the role of external experts in trainings and consultancy in this area while inviting university professors, experts from partner-institutions or the best specialists of different areas. The lacking contribution from external experts in team-building was more often mentioned than the value-added of internal creative leaders, which shows that social trust and knowledge sharing inside an organization is smoother than externally. Experts did not mention the importance of engaging external partners into various teams due to heavy bureaucracy as well as vacant experience of communicating in a culturally and socially diverse environment. Communication among various partners should be accelerated via the use of modern technologies, such as hubs, applications, artificial intelligence, and etc. Strong partners could also contribute to cheaper and more efficient lifelong learning, positive image of civil service organizations, community spirit, society engagement, and sustainability.

Undeveloped civil servants' competences in various business administration areas diminishes the role of strategic partnerships in strategy development, limits the opportunities of reshaping political priorities as well as endangers communication of strategic plans and expectations to society. On the other hand, strategic partners could help in communication of strategies and strategy implementation progress to other stakeholders. The quality of performance is a key factor of organizational social image, and it is unlikely to improve it without key strategic partners.

New process innovation calls for innovative management of change, and communication efficiency is a catalyst during the time of change; however, only one expert with Business education background and nearly 20 years of experience in civil service emphasized the role of leaders in liaising different-level employees, negotiating, presenting suggestions and communicating the information. A team of leaders from different departments, built uniquely for communication during the time of change, is recommended, and horizontal communication should be based on modern technologies. Engaging employees in planning and managing changes is critical; however, only 4 civil servants emphasized the role of innovation and knowledge management while communicating with employees during the time of change. The ones having relatively less experience in civil service organizations accentuated the function of ideas generation and collection via technologies, art, life meetings and interactive seminars with innovation professors. Within each department and among departments, it is suggested to build smaller groups in order to discuss various challenges and solutions related to the change. The more experienced respondents were more conservative and mentioned traditional communication options, such as formal meetings with employees while presenting the change, new tasks and requirements, which are more in line with "Top-Down" management approach.

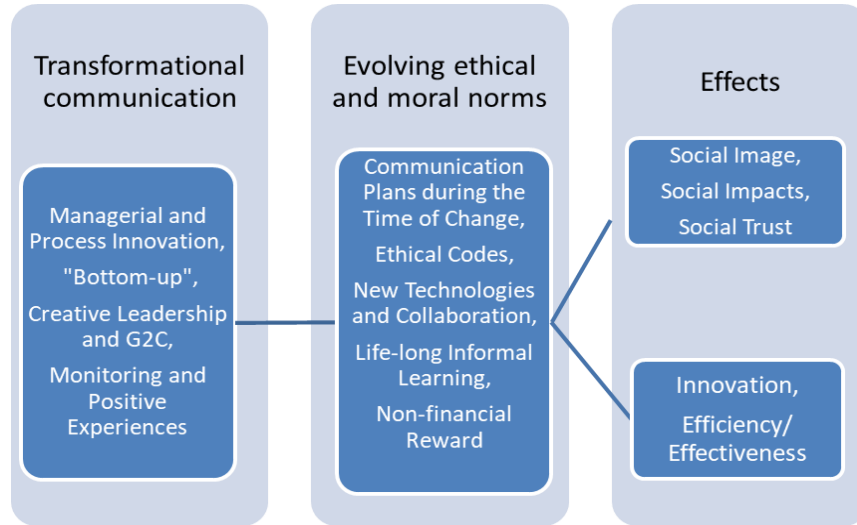
Innovation requires innovative marketing and communication tools; thus, it is impossible to run social image strengthening campaigns without application of Social Medias, and vice versa, external communication should be driven by new ways of engaging and gathering society. However, only one expert admitted that civil service organizations must use innovation via dissemination of good practices and activities as well as through interaction with society (while using online forums and meetings, social events, hubs, software applications, and etc.).

Within organization with limited financial motivation possibilities, innovation, and in particular innovation climate, might be a great solution. In light of rather conservative bureaucratic structures in Lithuanian civil service organizations, six experts emphasized the role of innovation from the context of non-financial rewards. The younger and less experienced civil servants were focused on innovation climate and leisure activities (community spirit; singing, dancing and sport activities; days with animals, lunch and dinner together, book club, consulting each other in various areas, voluntary work in organizations which take care of animals and elder people, leisure room, office kitchen, various informal social events, and etc.) as well as more flexible schedules or showing respect towards their work (for instance, nominations and reward of best employees, dissemination of good work practices on Intranet). The older and more experienced experts emphasized more practical aspects, such as flexible schedules, work from home, workplace comfort, interaction with colleagues, healthcare, medicine insurance, discounts in sport clubs, various premiums for innovative performance, seminars of employees' choice, and etc. Such trend reveals the untapped team-building potential, where, based on project and activity specificity, organizations could develop mixed teams (in terms of age, gender and nationality) in order to emphasize innovation, creativity and talent management at teams' level. It is particularly important in the context of limited cultural diversity while addressing many ethical and moral norms- related challenges.

It is not likely for civil service organizations to attract innovative and edge people if bureaucratic procedures are too long (still many paper documents in use, a lot of proofreading and confirmation signatures involved; too long processes and limited autonomy in decision-making), new technologies are not applied (2 experts noted the necessity to revive Intranet), and social image of public administration organizations is still negative.

The lack of innovativeness in Lithuanian Civil Service Organizations might be proved by the willingness to create "Innovative Ideas Bank", which was expressed by 10 experts. Although they do not specify a form or technology for ideas collection, they admit that it would be a great non-financial motivation mean; however, one of the most experienced and human resource management-related experts (who has been working in civil service organizations for nearly 25 years) emphasized the importance of preparing employees for this innovation, as it might be led by opposition and skepticism. This finding indicates the lack of communication between heads of departments and employees, as leaders do not feel and acknowledge employees' perception and expectations.

While adjusting the conceptual model of transformational communication effects, based on research results, the experts' responses were more concrete and centered on internal challenges rather than on multi-facet holistic approach to communication: experts emphasized the importance of applying more "Bottom-up" model (due to the lack of horizontal communication and severe rules), while limited financial reward opportunities and insufficient competences called for informal learning and non-financial reward means (for instance, team building or various events). Respondents pointed out at the transformational nature of civil service organizations (which is related to constant changes in political priorities and ongoing reforms); therefore, they lacked concrete communication plans during the time of change, based on positive experiences of other countries as well as profound expertise of external experts, such as university professors or even corporate partners. As it could be expected, the specialists' underlined communication effects were in line with scholars' interpretation.



**Fig. 2.** The Revised Conceptual Model of Transformational Communication Effects

*Source:* prepared by paper author, based on research results

In the context of knowledge diffusion among different-level employees, it is important to identify the main reasons why specialists choose or leave civil service organizations: for some of them it is the opportunity to use knowledge and skills acquired at university in order to enhance their competences; for others it is related to working hours; while innovation-driven candidates or employees want to be value-adding to entrepreneurship conditions, innovation processes, sustainability of the country. However, only 3 experts accentuated the role of innovation on career choice. It is also in line with another important dimension of innovation commercialization, which is team-building; only three experts mentioned this factor in the context of teams' innovation. This area is unknown and distant to experts: they have a rather negative perception on team-building in their organizations due to lacking competences, fragmented information and insufficient co-operation among colleagues both formally and informally. The informal communication was missed by 4 experts (dominant answer among younger and less experienced experts): they acknowledged the role of inter-personal communication in order to know and understand each other better, to share knowledge, experience and ideas, to build social trust and to understand better strategic targets of the organization.

It is interesting to note that experts distinguish the difference between creative leaders and specialists and suggest involvement of both groups in teams, ideas generation and strategic planning, along with employees' and society engagement. One of the youngest experts with two-year experience in Civil Service suggest the initiative "Help Your Colleague", which encourage social trust among colleagues via the system of stickers rewarded for assistance and support by other colleagues (employees with the largest number of stickers get remuneration). Moreover, only one expert interprets innovation in the context of cultural and social norms (moral and emotional state of a person or ethics), which shows the lack of holistic approach to innovation and creativity as well as untapped potential of techniques which refer to ethical and moral norms.

## Conclusions

Ethical and moral norms have a vast spectrum of effects on sustainable performance of Lithuanian civil service organizations (such as, efficiency, social image, society engagement, and social impacts); however, transformational communication (including a list of aspects, such as networking, realignment of perception and attitude, building and engaging community, running various-type innovation, enhancing creativity and leadership,

strengthening social trust, motivation, and etc.) is unlikely possible if an organization does not have its philosophy and techniques helping to apply ethical and moral norms in projects and activities.

It is recommended to engage employees and society in the development process of organizational ethical codes: starting from individual ethical codes, professional philosophy of each employee, and only then moving to the stage of behavior guidelines, communication documents and organizational ethical codes (Ferguson et al, 2016). This process requires ingenious research and profound comparison analysis of various examples of ethical codes worldwide, horizontal communication tools, and engagement of society via modern technologies, along with the presence of the highest-level governors and foreign specialists, and empowerment of leaders. Having clear code development stages and targets, ethical codes can be interpreted in the context of marketing, as they can strengthen social image of organizations via community building (for instance, social events), liaising organizational philosophy with cultural and social norms of community, including values and behavior principles.

A cross-departmental committee, specifically built for ethical code development purpose, should engage citizens and other stakeholders in decision-making and ethical code development process via new technologies and interactive events. Moreover, transformational leaders should acknowledge and address different dimensions and challenges related to social capital (for instance, social trust, the fear of failure, lack of self-esteem or nepotism), while relying on a more holistic and complex approach to transformational communications. The ethical and moral norms should be realigned accordingly in order to correspond to current trends across various economies, industries, and policies.

## References

- Abel, D.; MacGlashan, J.; Littman, M. 2016. Reinforcement of learning as a framework for ethical decision making, *The Workshops of the Thirtieth AAAI Conference on Artificial Intelligence, Ethics, and Society: Technical Report WS-16-02:8*. <https://pdfs.semanticscholar.org/4f3b/3459cd39ef417966b9859dfd69659327d99a.pdf>
- Aunjum, A.H.; Abbas, G.; Sajid, M. 2017. Transformational leadership and employee motivation in banking sector of Pakistan, *Advances in Economics and Business*, 5(9): 487 – 494. <https://doi.org/10.13189/aeb.2017.050901>
- Boatright, J.R. 2006. What's Wrong – and What's Right – with Stakeholder Management, *Journal of Private Enterprise*, 21 (2): 106-130, ISSN 0890-913X.
- Bud'urova, B. 2015. Evolution of Ethics, *E-LOGOS – Electronic Journal for Philosophy*, 22(1): 71–76. ISSN 1211-0442 <https://doi.org/10.18267/j.e-logos.415>
- Camargo, C.B.; Passas, N. 2017. Hidden agendas, social norms and why we need to re-think anti-corruption, *OECD Global Anti-Corruption & Integrity Forum*, p. 17. <https://www.oecd.org/cleangovbiz/Integrity-Forum-2017-Baez%20Camargo-Passas-hidden-agendas-social-norms.pdf>
- Currstine, T.; Lonti, Z.; Joumard, I. 2007. Improving public sector efficiency: challenges and opportunities, *OECD Journal on Budgeting*, 7(1). ISSN 1608-7143.
- Davidavičienė, V.; Raudeliūnienė, J.; Tvaronavičienė, M.; Kaušinis, J. 2019. The importance of security aspects in consumer preferences in electronic environment, *Journal of Security and Sustainability Issues*, 8(3): 399-411. [http://doi.org/10.9770/jssi.2019.8.3\(9\)](http://doi.org/10.9770/jssi.2019.8.3(9))
- Diakopoulos, N. 2016. Accountability in algorithmic decision making, *Communications of the ACM*, 59(2): 56–62.
- Donaldson, T.; Dunfee, T.W. 1999. *Ties That Bind: A Social Contracts Approach to Business Ethics*. Cambridge, MA: Harvard Business School Press, p. 320, ISBN 10: 0875847277.
- Etzioni, A.; and Etzioni, O. 2016. Designing AI systems that obey our laws and values, *Communications of the ACM*, 59(9): 29–31.



- Fang, W.T.; Ng, E.; Wang, Ch. M.; Hsu, M.L. 2017. Normative beliefs, attitudes, and social norms: people reduce waste as an index of social relationships when spending leisure time, *Sustainability*, 9(1696): 18. [www.mdpi.com/journal/sustainability](http://www.mdpi.com/journal/sustainability)
- Ferguson, J.; Ronayne, P.; Rybacki, M. 2016. Comparing Leadership Challenges: Civil Service vs. Private Sector. *White Paper: Part 2 in a 3-Part Series, Centre for Creative Leadership*, p. 20. <https://www.ccl.org/wp-content/uploads/2016/02/ComparingLeadershipChallenges.pdf>.
- Gálvez-Rodríguez, M.M.; Haro-de-Rosario, A.; Caba-Pérez, C. 2017. Improving citizens' online engagement via community managers: an explanatory study, *Regional Government of Andalusia (Spain), Department of Innovation, Science and Enterprise*: [Research Projects P10-SEJ-06628 and P11-SEJ-7700], pp. 1-17. <https://doi.org/10.1080/1369118X.2017.1315442>
- García-Marzá, D. 2017. From Ethical Codes to Ethical Auditing: an Ethical Infrastructure for Social Responsibility Communication, *El profesional de la información*, 26(2): p. 9. [http://www.elprofesionaldeinformacion.com/contenidos/2017/mar/13\\_esp.pdf](http://www.elprofesionaldeinformacion.com/contenidos/2017/mar/13_esp.pdf)
- Government Communication Service, 2017. *The UK Government Communication Plan: Our Priorities in 2017/2018*, Crown Copyright, p. 44. [https://gcs.civilservice.gov.uk/wp-content/uploads/2017/08/6.3149\\_CO\\_GCS-Comms-Plan\\_FINAL\\_WEB.pdf](https://gcs.civilservice.gov.uk/wp-content/uploads/2017/08/6.3149_CO_GCS-Comms-Plan_FINAL_WEB.pdf).
- Grieco, A.A.M. 2017. Does social capital dimensions foster innovation capabilities?, *Doctor Thesis, directed by Susana Carla Farias Pereira at Escola de Administração de Empresas de São Paulo*, p. 104. <https://bibliotecadigital.fgv.br/dspace/bitstream/handle/10438/18529/Final2-Tese-Guto-Nova-22-7-2017.pdf>.
- Growiec, K.; Growiec, J.; Kamiński, B. 2017. Mapping the Dimensions of Social Capital, *SGH KAE Working Papers Series*, No. 2017/025, p. 75. [http://kolegia.sgh.waw.pl/pl/KAE/Documents/WorkingPapersKAE/WPKAE\\_2016\\_025.pdf](http://kolegia.sgh.waw.pl/pl/KAE/Documents/WorkingPapersKAE/WPKAE_2016_025.pdf)
- Heath, J. 2006. Business Ethics without Stakeholders, *Business Ethics Quarterly*, 16(4): 533–57.
- House of Commons Science and Technology Committee 2017. Science communication and engagement, *Eleventh Report of Session 2016–17 Report, together with formal minutes relating*, p. 35. <https://publications.parliament.uk/pa/cm201617/cmselect/cmsctech/162/162.pdf>.
- Hovland, C.I. 1948. Social communication, *Proceedings of the American Philosophical Society*, 92(5): 371-375.
- Jiang, W.; Zhao, X.; Ni, J. 2017. The Impact of Transformational Leadership on Employee Sustainable Performance: The Mediating Role of Organizational Citizenship Behavior, *Sustainability*, 9(9): p. 17. <https://doi.org/10.3390/su9091567>
- Laužikas M.; Dailydaitė, S. 2015. Impacts of social capital on transformation from efficiency to innovation-driven business, *Journal of Business Economics and Management*, 16(1): 37-51. <https://doi.org/10.3846/16111699.2012.754374>
- Morris, Ch. 1946. *Signs, language, and behavior*. New York: Braziller, p. 376.
- Nilsen, T.R. 1957. On defining communication, *Speech Teacher*, 6(1):10-17.
- Norman, W. 2013. *Business Ethics*. The International Encyclopedia of Ethics. Edited by Hugh LaFollette, Blackwell Publishing Ltd, pp. 652–668. <https://doi.org/10.1002/9781444367072.wbiee719>
- Orozco-Toro, J.A.; Ferré-Pavía, C. 2013. La comunicación estratégica de la responsabilidad social corporativa, *Razón y palabra*, No. 83, p. 20. [http://www.razonypalabra.org.mx/N/N83/V83/20\\_OrozcoFerre\\_V83.pdf](http://www.razonypalabra.org.mx/N/N83/V83/20_OrozcoFerre_V83.pdf)
- Otterlo, M. 2017. *From Algorithmic Black Boxes to Adaptive White Boxes: Declarative Decision-Theoretic Ethical Programs as Codes of Ethics*. Vrije Universiteit Amsterdam, The Netherlands, arXiv:1711.06035v1, p.7. <https://arxiv.org/pdf/1711.06035.pdf>
- Paynton, S. T.; Hahn, L. K.; Lippert, L. (2016). *Survey of Communication Study*. Wikibooks, the Free Textbook Project: [https://en.wikibooks.org/wiki/Survey\\_of\\_Communication\\_Study](https://en.wikibooks.org/wiki/Survey_of_Communication_Study).
- Schramm, W. (Ed.) 1948. *Communication in modern society: fifteen studies of the mass media prepared for the University of Illinois Institution of Communication Research*. Urbana, IL: The University of Illinois Press, p. 252.
- Sorsa, V.P. 2008. How to explain socially responsible corporate actions institutionally: theoretical and methodological critique, *Electronic journal of business ethics and organization studies*, 13(1): 10. <https://jyx.jyu.fi/dspace/handle/123456789/25416>.
- Stevens, S.S. 1950. Introduction: A definition of communication, *The Journal of the Acoustical Society of America*, 22(6): 689–690.

Taylor, J.; Yudkowsky, E.; LaVictoire, P.; Critch, A. 2017. *Alignment for advanced machine learning systems*. MIRI.  
<https://intelligence.org/2016/07/27/alignment-machine-learning/>

Tene, O.; Polonetsky, J. 2014. A theory of creepy: technology, privacy, and shifting social norms, *Yale Journal of Law and Technology*, 16(1): 45. <http://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?article=1098&context=yjolt>

Tvaronavičienė M. 2018. Towards internationally tuned approach towards critical infrastructure protection, *Journal of Security and Sustainability Issues*, 8(2): 143-150. [https://doi.org/10.9770/jssi.2018.8.2\(2\)](https://doi.org/10.9770/jssi.2018.8.2(2))

Uusi-Kakkuri, P. 2017. Transformational leadership and leading creativity, *Academic Dissertation at University of Vaasa, Faculty of Business Studies, Department of Management, Vaasan yliopisto*, p. 283: ISBN 978-952-476-748-4, ISSN 0355-2667.  
[http://www.uva.fi/materiaali/pdf/isbn\\_978-952-476-749-1.pdf](http://www.uva.fi/materiaali/pdf/isbn_978-952-476-749-1.pdf)

Walraven, K. 2008. *TIGed Update 2.4.*, TakingITGlobal, Nov. post.  
<https://www.tigweb.org/community/newsletters/html/view.html?edition=t283&layout=tiged>

Yonazi, E.; Kelly, T.; Halewood, N.; Blackman, C. 2012. The Transformational use of information and communication technologies in Africa, *The World Bank and the African Development Bank*, p. 166.  
<http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/MainReport.pdf>

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## ORGANIZED CRIME IN THE PRODUCTION AND DISTRIBUTION OF FALSIFIED MEDICINES IN POLAND: OUTLINE OF THE PROBLEM\*

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**Abstract.** Pharmaceutical crime has become a global phenomenon, an element of organized global crime, alongside drug and arms trafficking. Therefore, in order to combat this issue, there is a need of co-operation of a number of factors such as: the legal system, its proper use, cooperation of entities obliged to combat crime (not only national but also international), appropriate social campaign. This paper refers to the aforementioned issues. It presents examples of actions of the Polish police in the fight against pharmaceutical crime as a form of organized crime. The article has been prepared within the frames of realizing a research project called “Understand the Dimensions of Organized Crime and Terrorist Networks for Developing Effective and Efficient Security Solutions for First-line-practitioners and Professionals” (Project: TAKEDOWN, H2020-FCT-2015, No: 700688).

**Keywords:** pharmaceutical crime, organized crime, medicines

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**Additional disciplines:** law

## **1. Introduction**

Pharmaceutical crime has become a global phenomenon, an element of organized global crime, alongside drug and arms trafficking. This results not only from the geographical scope, but also from the areas of danger, which include: 1) smuggling of counterfeit products, 2) production of counterfeit products, 3) placing counterfeit/falsified products on the market, 4) trading in prohibited products or against the required permit. Medicines or active substances are largely manufactured in China or India, and then they are sent in bulk quantities to other countries, often to other continents. The WHO data shows that about 1% of all medicinal products used in highly industrialized countries are falsified. As regards the whole world, the percentage of counterfeit medicines increases to 10%, whereas in such parts of the world as Asia, Africa and Latin America the number of falsified medicines available on the market reaches 30%. According to Secretary General of Interpol, falsified medicines are more dangerous than international terrorism which killed about 65,000 people for forty years, while in China alone, nearly 200,000 people die of using falsified and substandard drugs every year. The world "leader" in drug falsification is Nigeria (over 60 percent of all falsified medicines come from this country). Most counterfeited medicines in Nigeria include antimalarial medications, anti-inflammatory medications, analgesics and antibiotics. Inefficient antimalarial medications killed over 120,000 pre-school children in Africa in 2015. With regard to the activities of organized crime groups, international actions are taken to combat this practice. One of the examples is "He-era" operation (15 May - 17 June 2017), which involved 1150 law enforcement officers from police, customs, and regulatory authorities in seven countries - Benin, Burkina Faso, Ivory Coast, Mali, Niger, Nigeria and Togo - whose task was to liquidate illegal factories and supply chains. Raids on markets, stores, pharmacies, warehouses, vehicles and illegal factories have led to the seizure of over 41 million tablets and 13,000 boxes of illegal pharmaceutical and medical products valued at approximately \$ 21.8 million. About 150 people were arrested or prosecuted. The seized goods included health supplements, herbal products, analgesics, antibiotics, antimalarial drugs, vitamins, mineral supplements as well as printing and packaging equipment.

The article discusses the problems of organized criminal groups in the production and distribution of falsified medicines in Poland. It is addressed to specialists in combating crime, to officers of formations responsible for security and public order, as well as to students of the following faculties: internal security, law, accounting and taxes.

## **2. Pharmaceutical crime in Poland. Legal perspective - outline**

Poland has also been affected by pharmaceutical crime in each of its forms, this is a transit country, a country where counterfeit/falsified products are placed on the market and illegally traded, as well as a country where counterfeit/falsified products are produced. That is why the Polish legal system has been adapted to European standards in the area of combating and preventing this phenomenon. The question that needs to be asked is whether we have sufficient legal, procedural and other measures to deal with organized pharmaceutical crime.

The adoption by the Sejm (the lower house of the Polish Parliament) of the Act of 6 September 2001 - Pharmaceutical Law (Journal of Laws No. 126, item 1381, as amended), the Act on the Office for Registration of Medicinal Products, Medical Devices and Biocidal Products (Journal of Laws No. 126, item 1379, as amended), the Act on medical devices (Journal of Laws No. 126, item 1380, as amended), the Act - Regulations introducing the Act - Pharmaceutical Law, the Act on Medical Devices and the Act on the Office for Registration of Medicinal

Products, Medical Devices and Biocidal Products (Journal of Laws No. 126, item 1382, as amended), initiated the adaptation of Polish legislation to the acquis of the European Union in the field of pharmaceutical issues. The content of the Act specifies: the principles and procedure for the authorization of medicinal products, in particular as regards the quality, efficacy and safety requirements for their use; conditions for conducting clinical trials on medicinal products; conditions for the manufacture of medicinal products; requirements for advertising of medicinal products; conditions for the marketing of medicinal products; requirements for pharmacies, pharmaceutical wholesalers and non-pharmacy outlets; organization and principles of operation of the pharmacovigilance system of medicinal products and monitoring the safety of their use; tasks of the Pharmaceutical Inspection and the powers of its authorities. In accordance with the content of art. 1 (2) of the aforesaid Act, the provisions of the Act are also applicable to medicinal products being narcotic drugs, psychotropic substances and precursors within the meaning of the provisions on counteracting drug addiction, to the extent not regulated by these provisions.

Changes in the Pharmaceutical Law Act resulted from the evolution of European law on medicinal products. As a result, on 20 April 2004, the Act amending the Pharmaceutical Law, the Act on the Medical Profession and the Act - Regulations introducing the Pharmaceutical Law Act, the Medical Devices Act and the Act on the Office for Registration of Medicinal Products, Medical Devices and Biocidal Products were passed (Journal of Laws No. 92, item 882) with the aim of implementing Directive 2001/20/EC of the European Parliament and of the Council of 4 April 2001 on the approximation of the laws, regulations and administrative provisions of the Member States relating to the implementation of the principles of good clinical practice in conducting clinical trials of medicinal products intended for human use and adaptation of the provisions of the Act - Pharmaceutical Law to the requirements of Directive 2001/83/EC of the European Parliament and of the Council of 6 November 2001 on the Community code relating to medicinal products intended for human use and Directive 2001/82/EC of the European Parliament and of the Council of 6 November 2001 on the Community code relating to veterinary medicinal products. The changes resulted from the implementation of the provisions of the following Directives of the European Parliament and of the Council: 1) 2004/24/EC of 31 March 2004 amending Directive 2001/83/EC on the Community code relating to medicinal products intended for human use, as regards traditional herbal medicinal products, 2) 2004/27/EC of 31 March 2004 amending Directive 2001/83/EC on the Community code relating to medicinal products intended for human use, 3) 2004/28/EC of 31 March 2004 amending Directive 2001/82/EC on the Community code relating to veterinary medicinal products. In addition, a more accurate implementation of Directive 2001/20/EC has been executed. In 2015 the Pharmaceutical Law Act was amended. These changes were compelled particularly by the necessity of adapting Polish regulations to the law of the European Union in this field. The implementation of EU provisions concerns Directive 62/2011/EC of the European Parliament and of the Council. The first amendment this year was announced on 8 January (the Act of 19 December 2014 on amendment of the Pharmaceutical Law Act and some other acts). The new amendment has already been adopted by the Sejm on 9 April. Another amendment to the law was brought by the Act of 7 April 2017 amending the Pharmaceutical Law Act of 25 May 2017, item 1015.

The aim of the changes was not only to adapt the Polish law to the EU assumptions in the described scope but to shape them in such a way as to ensure the tightness and safety of the distribution chain of medicinal products and eliminate any irregularities during this process. In the discussed field, particular attention should be paid to the content of the provision of art. 124b. 1. Whoever produces a falsified medicinal product or a falsified active substance is subject to a fine, the penalty of restriction of liberty or the penalty of deprivation of liberty for up to 5 years. 2. The same penalty shall be imposed on a person who provides or makes available a falsified medicinal product or falsified active substance for payment or free of charge, or holds a falsified medicinal product or falsified active substance for this purpose.

The content of the provisions of art. 38a) and the next art. explains the concept of a falsified medicinal product, which is a medicinal product, excluding the medicinal product with an unintended quality defect, which has been

falsely presented in terms of: a) the identity of the product, including its packaging, label, name or composition with respect to any ingredients, including excipients, and the strength of these ingredients, b) its origin, including its producer, country of production, country of origin or responsible entity, or c) its history, including data and documents regarding the distribution channels used; and (38b) falsified active substance - which is the active substance, excluding the active substance containing an unintentional quality defect, which has been falsely presented in terms of: a) the identity of the product, including its packaging, label, name or composition with respect to any ingredients, including excipients, and the strength of these ingredients, b) its origin, including its producer, country of production, country of origin or responsible entity, or c) its history, including data and documents regarding the distribution channels used;

In the fight against pharmaceutical crime, other provisions apply as well:

- Criminal Code - art. 165 para. 1(2); and also art. 156, art. 157 and art. 160;
- Act of 06.09.2001 - Pharmaceutical Law - art. 124-132;
- Act of 30.06.2000 - Industrial property law - art. 304 and 305;
- Act of 25.08.2006 on food and nutrition safety - art. 96-99.

The legal act helpful in combating counterfeiting is EC Regulation No. 1383/2003, which allows customs services to seize goods suspected of infringing intellectual property rights.

### **3. State administration institutions obliged by law to prevent and combat pharmaceutical crime in Poland**

Various entities have been granted the right to analyze risks of the violation of pharmaceutical law from different angles. These include the Main Pharmaceutical Inspector and his subordinate units, the Chief Sanitary Inspector and his subordinate units, the Office for Registration of Medicinal Products, Medical Devices and Biocidal Products, the Office of Competition and Consumer Protection, government institutions such as the Ministry of Justice, Customs Services, Border Guard, Office Patent, Patent Attorneys. One of the entities is also the National Medicines Institute, which was established as a result of the merger of the Institute of Medicines with its registered office in Warsaw and the Central Laboratory of Sera and Vaccines based in Warsaw and was named the National Institute of Public Health. On 8 December 2006, the Institute was named the National Medicines Institute (on the basis of the Regulation of the Minister of Health of 3 November 2006, Journal of Laws No. 210 item 1554). In 2007, the National Medicines Institute (member of the OMCL Network) prepared 226 opinions on 354 illegal products (including 44 medical devices), in 2008 - 70 opinions on 439 products (including 21 medical devices), and in the first quarter of 2009 - 27 opinions on 91 products. Particularly noteworthy are the more and more visible actions of the Team for Falsified Medicinal Products, set up at the Main Pharmaceutical Inspectorate.

This team coordinates the activities of pharmaceutical inspection, laboratory control, customs services, police and prosecution, aimed at effectively detecting and combating this problem in Poland. The team consists of representatives of the following authorities:

- Main Pharmaceutical Inspector;
- Minister of Health,
- President of the Office for Registration of Medicinal Products, Medical Devices and Biocidal Products,
- Chief Sanitary Inspector,
- Prosecutor General,
- Commander-in-Chief of the Police,
- Head of the Customs Service,
- President of the Office of Competition and Consumer Protection,
- Head of the National Medicines Institute and
- Chief Veterinary Officer.

The main goal of the team is to:

- set directions of counteracting the phenomenon of falsification of medicinal products,
- prevent the sale of medicines in unauthorized places,
- plan and implement activities related to reporting falsified medicinal products,
- conduct educational campaigns on the risks associated with the purchase of medicines in unauthorized places.

Officers of the General Police Headquarters together with the representative of the National Medicines Institute have also developed examples of questions helpful in formulating provisions of police and prosecution, prepared to prosecute pharmaceutical crimes.

- What is the chemical composition of the products sent? Which active substances are contained in the seized products?
- Do the products in question meet the definition of a medicinal product according to ProFarm?
- Are the seized medicinal products authorized in Poland?
- Does the chemical composition of the seized medicinal products the same as of the original products available on the Polish market?
- Do the seized medicinal products meet the quality requirements specified for this type of products?
- How the seized medicinal product(s) work(s)?/ Does the self-medication (i.e., without a doctor's prescription) with the use of this product pose a risk to life or health for the person taking it?/ Does taking the medication in question expose the person to immediate danger to life or serious health detriment?

Pharmaceutical crime raises difficulties not only because of its diverse form or criminal organization. It turns out that detailed data on, for example, falsified medicines is difficult to obtain and impossible to be interpreted in a measurable format and published. Therefore, the question is whether there is any possibility of estimating the market of informal and illegal nature. An additional difficulty is the fact that the functioning of organized crime groups is based on registering non-existing production and transport companies in order to disguise their actual activity. They use falsified documents to gain access to essential pharmaceutical raw materials or devices, in order to produce fake products and packaging, and then place them on a selected market or to a legal distribution network. They take advantage of all the weaknesses of the services involved in combating and preventing crime. It is interesting that the pharmaceutical industry, despite the losses totaling billions, is reluctant to oppose illegal competition.

Since 2016, as part of the operations conducted by the Central Police Bureau of Investigation, 6 939 (6 829) persons, operating in 874 (812) organized criminal groups, including 739 (725) Polish groups, 126 (83) international groups, 3 (2) Russian-language groups, 6 (2) groups of foreigners, have been kept under observation. Number of criminal groups (by nationality) remaining under observation of the Central Police Bureau of Investigation in 2015 and 2016, Polish criminal groups were directed by 730 (731) identified leaders, international groups by 97 (92), Russian-speaking groups by 3 (3), and foreigners by 3 (6). As at 31 December 2016, the total number of leaders under observation of the Central Police Investigation Bureau was 833 (832). During the reporting period in question, 143 (190) criminal groups operating in the area of criminal offenses and 290 (237) criminal groups involved in drug-related crime remained under observation. 341 (320) groups were involved in economic activity and 100 (65) groups were active in the area of multi crime activity.

It is almost impossible to distinguish a falsified drug from the original without a special equipment, and criminals are more and more accurate in counterfeiting of packaging and holograms, they also shift to a more cost-effective production of complex medicines containing many active substances. Criminal groups change their activities from drug-related to pharmaceutical crime.

As regards Poland, despite the appropriate legal structure, cooperation of many entities and the fact that in Europe we are classified as a high-risk country in terms of organized crime and counterfeiting of various products, there



is still no official data on the scale of the phenomenon of pharmaceutical crime. It is due to the difficulty of estimating this market value, because the average for the EU is given, which is EUR 350 million. In the case of Poland, the error in these calculations is large and it can range from EUR 100 to 150 million per year. The market of falsified medicines purchased in Poland is calculated at EUR 65 million. The fact that we are neighbors with the countries of the former USSR, known for easy access to falsified medicines and dietary supplements, translates into easy expansion of the products through illegal channels to the Polish market and further to other EU countries. When analyzing orders sent to the National Medicines Institute by police headquarters, prosecutors' offices or customs services, we can divide illegal and falsified products reaching Poland into seven groups:

- Illegal and falsified medicinal products and dietary supplements, recommended for erectile dysfunction - containing sildenafil, tadalafil, vardenafil or their derivatives,
- Falsified herbal dietary supplements for weight loss - containing sibutramine, monomethyl sibutramine or dimethyl sibutramine,
- Illegal and falsified steroid and anabolic hormones,
- Illegal herbal raw materials and products of Traditional and Chinese Medicine,
- Illegal and falsified dietary supplements and cosmetics available in sex shops - containing cantardine, yohimbine, benzocaine or lidocaine,
- Some of them bear the markings typical for homeopathic medicines, e.g. Cantharis D6 or Yohimbinum D4,
- Various dietary supplements working "wonderfully" and healing all diseases,
- „Designer Drugs"- containing BZP (N-benzylpiperazine), a psychoactive substance with a stimulating effect. The effect of BZP in combination with TFMPP (3-trifluoromethylphenylpiperazine) may resemble the effect of using Extasy tablets (MDMA).

According to the Report of the World Health Organization (WHO), Poles spend about PLN 100 million annually on counterfeit medicines. Poles buy them in different ways. They usually purchase such medicines by means of the Internet and still on bazaars. Of course original medicines are available in the Internet as well, however these usually are products of a theft. Demand for a product is a determinant of specific criminal activities.

According to official statistics, in 2016, the Main Pharmaceutical Inspectorate received 58 reports on illegal trade in medicinal products and 18 notifications in the international WGEO Rapid Alert System regarding the detection of illegal pharmaceuticals. In turn, the Customs Service has detained over 18.6 thousand counterfeit medicinal products with a value exceeding PLN 830 thousand.

Examples of police actions:

1. „14 people are detained, 48 different types of machines used to produce falsified medicines, 430 thousand steroids in ampoules and tablets and 100,000 potency tablets with a total black market value of over PLN 17 million are seized - this is the effect of several months of work by the Central Police Bureau of Investigation in Poznań (2016). Thus, the police officers liquidated the first in the world and the world's largest illegal pharmaceutical factory, and disbanded the organized criminal group involved in the production and large-scale trading of steroids and potency drugs. The arrests took place in the following voivodships: Kujawsko-Pomorskie, Śląskie, Pomorskie and Wielkopolskie. 3 persons faced charges of directing the group, and the remaining ones were accused of being its members. They were also accused of violating pharmaceutical law and endangering the life and health of many people. Police officers from the Central Police Bureau of Investigation worked several months to determine who is responsible for the production and large-scale trade of falsified pharmaceuticals. They determined that an illegal factory of medicinal products, counterfeiting medicines of four well-known pharmaceutical concerns, was set up near Bydgoszcz. They also identified persons involved in various stages of the procedure, starting from the production process through distribution. At the same time, policemen entered several places in four voivodships: Wielkopolskie, Kujawsko-Pomorskie, Pomorskie and Śląskie, and detained 14 people involved in illegal activities. The factory was located near Bydgoszcz. On the spot, the police arrested a

man who was involved in the production of falsified medicines. In storage rooms there were special passages, hidden behind the doors of wardrobes, leading into further production rooms equipped with various types of machines. The policemen also seized ready-made products as well as their semi-finished products. In total, the officers have seized 48 machines: blanking dies, screen printing machine, pad printing machine, image setter, tablet press, blistering machines, coating machines, ampoule machines, storage reservoirs, packing machines, mixers and other. There were also 377 stamps for production, 23 printing screens, 28 printing matrices. The total value of the equipment amounted to over PLN 4 million. In addition to production components, police officers have seized finished products: anabolic steroids in ampoules, vials and tablets, as well as 100,000 potency tablets. As policemen determined, some of the finished products, as well as semi-finished products were imported from China through the transfer channel via Greece, as well as Great Britain and Romania. The distribution took place mostly by means of the Internet. These products threatened the life and health of buyers due to conditions of their production as well as differences in composition. It is estimated that the group launched falsified products worth at least several million PLN. In addition to charges of directing or participating in an organized criminal group, detainees were accused of endangering life or health of many people by the production, storage and making available in return for payment of falsified medicinal products, as well as the import of finished medicinal products and active substances, and the marketing of medicinal products.”

2. „As a result of the actions of police officers from the Central Police Bureau of Investigation in Rzeszów, officers from the Bieszczady Border Guard Division and authorities from the Czech Republic, Slovakia, Ukraine and Europol, 44 people were detained, three methamphetamine laboratories and a marijuana plantation were liquidated. Drugs were being sent to the laboratories. The criminal practice started in Podkarpacie, where drugs containing pseudoephedrine were obtained. - The medicines were taken from pharmacies and pharmacy points. Each receipt contained a sale transaction for one medicine packaging. In reality, however, these drugs were received in bulk by "couriers", and such situations could have involved even several tens of thousands of packages at one time. The tablets were then removed from blisters, i.e. separated from the packaging and delivered directly to several methamphetamine laboratories. 23 people were detained in Poland, out of which 19 were temporarily arrested on the basis of collected evidence by the District Court in Rzeszów. As a result of the activities of officers, over 200,000 packages of medicines and about 100 kg of tablets were seized. In addition, officers seized PLN 1.2 million in cash and cars with a value of approx. PLN 400,000. According to the decision of the prosecutor, bank accounts for the amount of about PLN 5 million were blocked. Police officers from the Central Police Bureau of Investigation in Warsaw and Katowice, the Voivodship Police Headquarter in Rzeszów, anti-terrorists, officers of the Internal Affairs Office and officers from the Delegation of the Internal Security Agency from Rzeszów also took part in the operation conducted in Poland. Another 8 people have been detained in the Czech Republic, they are suspected of organizing criminal activities and the production of narcotic drugs. Several hundred thousand euros have been secured against future fines. The Czech and Slovak authorities dismantled two methamphetamine factories and a marijuana plantation in the Czech Republic. Additionally, seven people suspected of participation in an organized criminal group, trading in precursors and drugs were detained in Slovakia. There, the Slovak police also seized chemical agents used for the production of methamphetamine and a few dozen kilos of tablets removed from blisters. "The case is in progress. In Ukraine, the officers of the local services, basing on the information received from the Central Police Bureau of Investigation in Przemyśl, dismantled a methamphetamine laboratory and detained 6 people.”

## Conclusions

Money rules the world, which is why organized crime groups will not hesitate to take any opportunity to make easy money. As it turns out, the need for medications, as well as the aforesaid difficulties provide them enormous opportunities in this area. The fight against the broadly understood pharmaceutical crime requires not only the



involvement of a functioning legal system and cooperating legitimate entities, but also social campaigns that should be joined by the media which, so far, fuel the pseudo-demand for drugs through advertising.

## References

Fijałek Z., Sarna K. 2009. *Wybrane aspekty jakości produktów leczniczych i suplementów diety — produkty substandardowe, nielegalne i sfalszowane*, [Selected medicinal and supplementary products - substitute, illegal and fake products], Rynek Farmaceutyczny [Pharmaceutical Market], 65, 7 [http://ptfarm.pl/pub/File/FP/7\\_2009/02%20%20leki%20sfalszowane.pdf](http://ptfarm.pl/pub/File/FP/7_2009/02%20%20leki%20sfalszowane.pdf)

Fijałek Z., Sarna K. 2009. Falszowanie leków i inne przestępstwa farmaceutyczne, [Falsification of medicines and other pharmaceutical crimes], Problemy Kryminalistyki [Forensics problems], 26, p. 5

Nowak A. 2015. Falszerstwa na rynku suplementów diety i produktów leczniczych [Fake dietary supplements and medicinal products], in Lewkowicz A., Pływaczewski P.(Ed). Przeciwdziałanie patologiom na rynku żywności [Counteracting pathologies in the food market].Szczotno:WSPol Press, 103-119.

Interpol <https://www.interpol.int/News-and-media/News/2017/N2017-107>

Bartwicka M. 2015, Nowelizacja prawa farmaceutycznego - sfalszowane produkty lecznicze [Amendments to the Pharmaceutical Law - falsified medicinal products], Panacea- leki ziołowe [Panacea- herbal medicines], 3(52) p.12-13 <http://www.panacea.pl/articles.php?id=5204>

Coraz więcej fałszywych leków na polskim rynku: "Podrabianie ich jest łatwiejsze niż banknotów [More and more fake medicines on the Polish market :Gaining them is easier than banknotes] 2015 <http://tvn24bis.pl/z-kraju.74/przestepczosc-farmaceutyczna-jest-coraz-wiecej-falszywych-lekow.533433.html>

Fijałek Z. 2017. Falszowanie leków to ludobójstwo [Faking drugs is genocide], Medekspres.pl <http://www.medekspres.pl/falszowanie-lekow-to-ludobojstwo/67874>

GIF o fałszowaniu narkotyków: nie możemy czuć się bezpiecznie [GIF about drug falsification: we can not feel safe], 2017, Finanse i zarządzanie [Finance and management] <http://www.rynekaptek.pl/marketing-i-zarzadzanie/gif-o-falszowaniu-lekow-nie-mozemy-czuc-sie-bezpieczni.22450.html>

Rozbity międzynarodowy gang narkotykowy [Wrecked international drug gang]. 2017. Policyjny Serwis Informacyjny [Police Information Service] <http://isp.policja.pl/isp/aktualnosci/11520,Rozbity-miedzynarodowy-gang-narkotykowy.html>

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## PROSPECTS FOR INNOVATIONS IN MARKETING OF ECONOMIC EDUCATIONAL SERVICES IN UKRAINE

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**Abstract** The article is devoted to the prospects for innovations in marketing of economic educational services in Ukraine. The research of expectations and requirements of employers for competencies of graduates of institutions of higher economic education has been conducted. «Career growth» has been chosen as the main criterion for determining the totality of competencies of graduates significant for employers. The clustering of employers was carried out on the results of the survey of employers and their assessments of the requirements for competencies of graduates of institutions of higher economic education, necessary for «career growth». The following clusters have been identified: «perfectionists», «maximalists» and «minimalists», who have different requirements for competencies of graduates of institutions of higher economic education. The obtained results became the basis for determining the prospects for innovations in marketing of economic educational services, orienting graduates at certain behavioral models in the process of study. This will be the key to their success in the field of professional activity.

**Keywords:** innovations, marketing, economic educational services, employers, competences, institutions of higher economic education

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**Additional disciplines:** sociology; educology.

### 1. Introduction

Innovations, which, in the first place, are understood as new developments, are designed to ensure the development of an individual, an organization, a society as a whole. With the high rates of change in the requirements for specialists in the labor market, the trend towards lifelong learning is becoming increasingly important. Since the employers are the customers in the labor market, then the knowledge of their tastes, preferences, expectations, needs will allow us to determine the prospects for innovations in the field of economic

educational services. Innovation is a dynamic concept, subjected to constant change. Innovations in marketing of educational services in general and economic educational services, in particular, will help the scientists to identify the ways of improving the quality of higher economic education.

Innovations in marketing of educational services are focused on creating the conditions for interaction of those participants who strive not only to increase the amount of knowledge, but also to improve the quality of knowledge. Interaction of graduates of universities and employers will provide sustainable understanding how to organize the process of forming the competences of graduates to lay the foundation for a successful professional activity of employers. The arguments which foreign scientists propose should be taken into consideration. «People most of the time are rational actors who aspire to minimize the costs and maximize the benefits of their behavior. This is of course the basis of rational choice theory which underlies modern economics and is gaining ground in the other social sciences. In any case, to the extent that people behave to maximize their benefits, they will select, or rediscover, or invent more efficient systems of interaction» (Bejan, Merks, 2007).

To invent more efficient systems of interaction in marketing of educational services scientists and practitioners should share their experience in professional activity. They should take into account the results of monitoring the opinions of employers about the quality of competences of graduates, results of monitoring of employment of graduates. Especially important is to have the information whether graduates work in accordance with the received specialty.

The information about the reasons why graduates do not work in accordance with the received specialty is also very useful. As the results of the survey show, the possible reasons are: 1) competences received at universities do not meet the requirements of employers; 2) graduates get a job to have high salary, work in accordance with the received specialty does not matter; 3) results of education do not meet the expectations of graduates; 4) conditions of professional activity do not satisfy graduates as future employees (bad equipment, social package, inconvenient work schedule etc.); 5) initially graduates were interested in obtaining any diploma of higher education; 6) graduates find themselves in a situation where they can't find a job in accordance with the received specialty. All these reasons may be interpreted as risks. To minimize these risks, it is necessary to conduct marketing research of the problems in the sphere of educational services and propose innovations in it.

Today, Ukraine ranks 88th among 189 countries of the world on the human development index (HDI) (United Nations Development Program, 2018). Moreover, this position is largely due to the level of education of citizens of Ukraine. The number of people with higher education among Ukrainians (Table 1) is high by world standards.

**Table 1.** UN and the State Statistics Service of Ukraine data on the HDI on education in Ukraine

Years	HDI	Gross enrollment ratio of the population in higher education (% of the population with higher education among the total population who have reached the age of higher education), %	Graduated from school (11 classes), thous. of people	Number of persons admitted to institutions of higher education, thous. of people	Number of persons graduated from institutions of higher education, thous. of people
2014	0,748	79	247	361,1	484,5
2015	0,743	82	229	323,1	447,4
2016	0,746	79	211	313,8	386,7
2017	0,751	83	203	323,5	421,1

*Source:* composed by the authors according to the data of the United Nations Development Programme, the State Statistics Service of Ukraine

According to the World Economic Forum, Ukraine ranks 10-12 in the world in terms of the degree of enrollment in higher education. At the same time, according to the World Bank's «Skills for Modern Ukraine» study, the level of education has little effect on the wages received. There is a gap between the competencies acquired by students and those that employers need (Ximena et al., 2017).

## 2. Theoretical background

Issues of innovation in marketing of educational services in general and economic educational services, in particular, the interaction of employers and educational institutions have been researched by Ukrainian and foreign scientists. Among them Illiashenko (2016), who studied management and marketing of innovations, knowledge marketing in a virtual environment in the market of scientific and educational services. The scientist noted that in economics, innovations are considered as a way to improve the efficiency of the use of available resources. «From the point of view of subjects of economic activity, innovations are considered as means of their adaptation to changes in the external environment, which are capable of ensuring their long-term survival and development relative to the chosen mission. An important role in ensuring the success of innovation activity is played by the marketing of innovations, which is defined as an activity aimed at finding new areas and ways to use the potential of an organization, creating on this basis new products and technologies to promote them in the market in order to satisfy consumer needs more effectively than competitors by means of this, making profit at the expense of it and ensuring conditions of long survival and development in the market» (Illiashenko, 2016). Illiashenko suggested using innovations and directly marketing innovations, including relative knowledge and educational services, as a driving force for the development of the Ukrainian economy and ensuring the independence of the country based on the principle of «ahead of not catching up» (Illiashenko, 2016). Fedulova (2015) considered marketing innovations: systematization of their types and practice of application by Ukrainian enterprises. Prokopenko, Bozhkova and others (2016) studied the formation of the concept of marketing of educational services, marketing approaches to the promotion of educational services. Martynenko, Lysytsia, Prytychenko (2018) justified the list of innovative technologies and types of marketing of economic educational services. Semchuk (2017) conducted a study of diagnosing educational projects, programs, academic disciplines with regard to risks in the system of «enterprise – educational institution».

Dudzevičiūtė and Tvaronavičienė (2011) considered innovative activity from the point of view of its conceptual bases, as well as its assessment. Laužikas and Dailydaitė (2013) studied social capital and its innovative opportunities for enterprises. First of all, the concept of social capital and its role are defined referring to a set of scientists' interpretations on social capital and economic/social development. The main patterns of innovation capabilities are revealed, followed by the methodology and research results presented. Kotler and Fox (1995) studied strategic marketing for educational institutions. Etzkowitz and Leydesdorff (2000) analyzed the triple helix model, the possibilities of interaction between the university, enterprises and the state. Lavrinenko, Ohotina, Tumalavičius, Pidlisna (Lavrinenko et al., 2016) studied the cooperation between the participants of innovation systems: universities, enterprises and the state. Porter (Porter et al., 2010) studied the educational cluster in the state of Massachusetts, its role in the US education sector. Rai, Raguraman, Veerappan (Rai et al., 2013) considered a strategy for meeting customer needs. Immaisi analyzed the marketing of educational services for export (Immaisi, 2014), Al-Dulaimi (2016) considered an attempt to solve the issue of the quality of educational services at institutions of higher education. Išoratė, Steiblienė, Mečėjienė (Išoratė et al., 2014) studied the theoretical aspect of professional competences, and also conducted a study of the professional competencies of graduates among employers to improve the quality of higher education. They express the opinion that college graduates perceive their professional qualities and competencies obtained during studies. Respondents of this research identified that they make hiring decisions based on individual interviews, recommendations and selection testing results. They are satisfied with all graduates, who eagerly improve their professional skills in various areas of expertise. Graduates have adequate theoretical knowledge base, decent organizational skills and have enough

knowledge of foreign languages. General qualities of graduates were highly evaluated. This paper has showed that personal qualities have an impact on professional activities; these qualities are responsibility, activity in workplace and efficiency. Dzemyda, Zacharevič, Nedelko addressed the issues of improving the education of international trade professionals (Dzemyda et al., 2015). Ananishnev, Beryozka, Krasilnikova (Ananishnev, 2015; Beryozka, Krasilnikova, 2016) analyzed the possibility of competitive functioning and development of an educational organization through the use of marketing tools. Abramova (2016) studied the integration of interests of employers and institutions of higher education, joint work to develop the necessary list of competencies of graduates. The integration of educational institutions and employers with the creation of educational clusters as centers for such integration was studied in the works of Igolkin (2015), Kuzmenko (2015), Shatalova, Kravtsova, Mihelkevich (2015). Igolkin, Kuzmenko and Shatalov (2015) devoted their research to the mechanism of formation and functioning of educational clusters. Kravtsov, Mikhelkevich (2015) reviewed the organizational and methodological foundations of function-oriented training of specialists in the framework of educational cluster. Higher education has faced issues of economic transformation, workforce development, massification, and reduced funding in previous years, but the urgency with which education is expected to respond to these changes by both government and the private sector is rather extraordinary. Innovative solutions will be necessary for universities to maintain their compact with government, align their programs with public objectives, and find solutions to societal problems (Tierney, Lanford, 2016; Senan, 2018).

### 3. Research objective and methodology

The objective of the article is to determine the prospects for innovations in marketing of economic educational services based on clustering of employers, depending on the importance of requirements for the competencies of graduates for career growth.

To achieve the objective it is suggested to solve the following tasks: 1) analyze the works of scientists on marketing of educational services; 2) carry out factor and cluster analyses for the purpose of segmentation of employers-respondents; 3) identify the prospects for innovations in marketing of economic educational services in Ukraine.

As part of the research, the authors developed a questionnaire for employers and conducted a survey of managers of enterprises of various forms of ownership and activities for the importance of the requirements for the competencies of graduates of economic specialties for «career growth». The sample size was 80 respondents-employers. The employers represent such spheres as machine-building industry, chemical industry, food industry, light industry, service industry and banks. Among the mentioned industries there are 16 big companies (mainly machine building industry, chemical industry, food industry and banks), 26 middle companies (mainly light industry, food industry), 38 small companies (service industry and banks). Top management is presented by employers of big companies and middle companies, small companies. Average level management – these are employers of middle companies and small companies. The lowest level of management is presented by employers of middle and small companies. In the list of employers' requirements for the competencies of graduates, the following were proposed:

- 1) constantly improve qualification;
- 2) know new software products;
- 3) speak 1-2 foreign languages;
- 4) be able to conduct business negotiations;
- 5) be emotionally restrained;
- 6) propose new real ideas;
- 7) have communication skills in professional environment;
- 8) be able to prepare successful presentations;
- 9) be able to work in a team.



#### 4. Results and discussion

The justification of the directions of innovative development of institutions of higher education is impossible without taking into account the requirements of employers for graduates. It should be noted that employers focus on various competency requirements for graduates when giving them employment and when in the future providing them the opportunity of «career growth». The clustering of employers allows us to divide them into groups (clusters) according to the degree of similarity. In future, it contributes to the adaptation of graduates to the requirements of employers.

During the survey, the employers-respondents assessed the importance of these requirements for the competencies of graduates of institutions of higher economic education for the «career growth» on a five-point scale.

According to the results of the employers' assessment of the requirements for the competencies of graduates, a factor analysis was carried out, which made it possible to identify the most important variables for the respondents (competencies) and perform their compression. Statistical data processing was carried out using the STATISTICA software. The results of the factor analysis are presented in table. 2

**Table. 2.** The results of factor analysis

Factors	Eigenvalues	Percentage of total variance attributed to factors	Cumulative own values	Cumulative percentage of variance explained by factors
1	3,170184	35,22427	3,170184	36,22427
2	1,360787	15,11985	4,530970	50,34412
3	1,085848	12,06498	5,616819	62,40910

*Source:* created on the basis of the survey, conducted by the authors

The cumulative percentage of variation, explained by selected factors, is 62.41%. This allows us to conclude that the result of the analysis is sufficient to determine the main macro-attributes regarding the importance of employers' requirements for the competencies of graduates of economic specialties.

To process the original data, the Principal components method was used. In the framework of this method, the selection of variables is based on the study of the loads of individual factors, which takes into account the proximity of the values of loads to unit. A load value of at least 0.7 is considered sufficient (Grechkov, 2006).

Based on the results of the factor analysis, six out of nine requirements for the competencies of graduates are identified, which are combined into three factors (Table 3).

**Table 3.** The matrix of factor loads

Variables	Factor 1	Factor 2	Factor 3
Var1	0,026706	0,031864	0,960811
Var2	0,031274	0,739667	0,329066
Var3	-0,067732	0,787713	-0,049574
Var4	0,423320	0,737349	-0,045641
Var5	0,566648	0,408735	0,021594
Var6	0,565548	0,220243	0,152218
Var7	0,518847	0,236347	0,396750



Var8	0,787351	0,064714	0,025243
Var9	0,832734	0,007829	0,019220
Total dispersion	2,410806	1,987977	1,218036
Proportion of total dispersion, due to factors	0,267867	0,220886	0,135337

Source: created on the basis of the survey, conducted by the authors

The results of factor analysis allow us to state the following. The first factor is the most influential. It explains 36.22% of the total variation of indicators. The most significant influence on this factor is exerted by such requirements of employers for the competencies of graduates as the following: «be able to prepare successful presentations» (0.79); «be able to work in a team» (0.83). The first factor is recommended to interpret as «partner-oriented».

The second factor explains 15.12% of the total variation of indicators and is characterized by such variables as: «know new software products» (0.74); «speak 1-2 foreign languages» (0.79); «be able to conduct business negotiations» (0.74). Based on the content and nature of this factor, it is advisable to interpret it as «advanced».

The third factor characterizes such a variable as «constantly improve qualification» (0.96) and explains 12.1% of the accumulated variation. The third factor is recommended to interpret as «pragmatic».

The results of the factor analysis show that the least important for employers-respondents are such requirements for the competencies of graduates as the following: «be emotionally restrained»; «propose new real ideas»; «have communication skills in a professional environment». This can be explained by the fact that «being emotionally restrained»; «be able to propose new real ideas»; «have communication skills in a professional environment» are the results of professional experience. Employers understand that graduates lack experience because it is acquired over time.

The clustering of employers according to their assessments of requirements for the competencies of graduates of economic specialties was carried out on the basis of cluster analysis using the K-medium method (Punj, Stewart, 1983). The quality of cluster analysis is confirmed by the results presented in Table. 4.

**Table 4.** Cluster analysis results

Factors	Distances between clusters	Number of degrees of freedom	Distances inside clusters	Number of degrees of freedom	F-criterion	p-level
1	22,96750	2	56,03250	77	15,7810	0,000002
2	21,67611	2	57,32389	77	14,5582	0,000004
3	66,18191	2	12,81809	77	198,7818	0,000000

Source: created on the basis of the survey, conducted by the authors

The results of the cluster analysis are reliable, since the error rate (p-level) does not exceed 5% (0.05).

Thus, 3 clusters were identified as a result of cluster analysis. (Table 5).

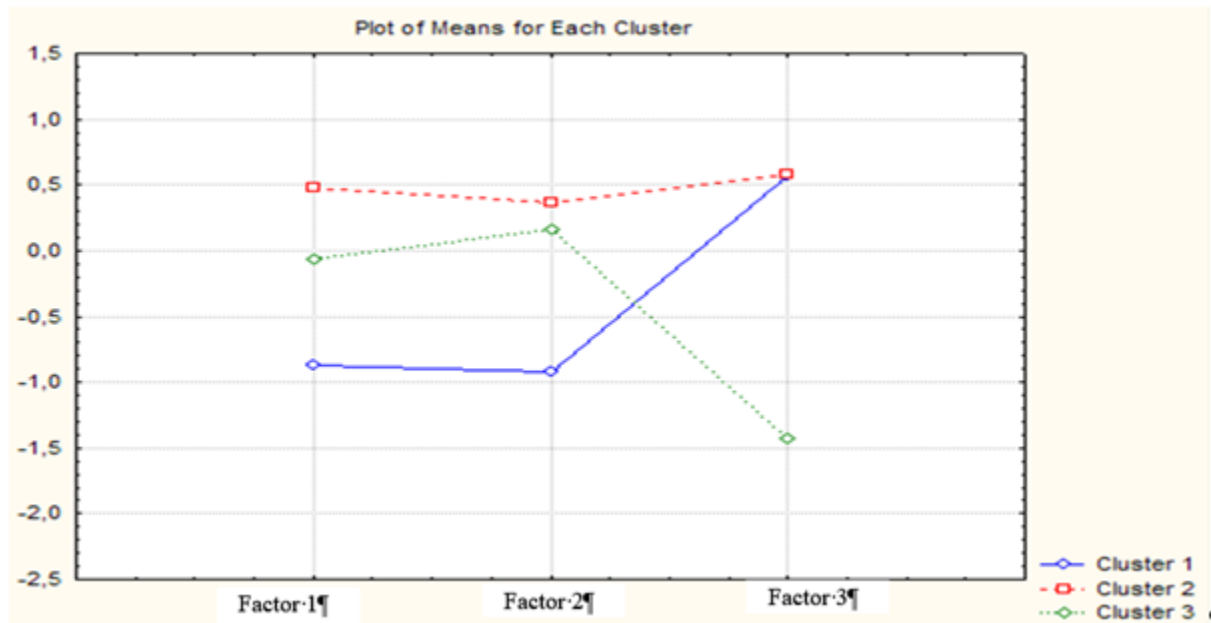
**Table 5.** Distances between the selected clusters

Cluster number	Euclidean distances between clusters		
	No. 1	No. 2	No. 3
1	0,000000	1,148538	1,944831
2	1,071698	0,000000	1,460196
3	1,394572	1,208386	0,000000

*Source:* created on the basis of the survey, conducted by the authors

The data in Table 5 indicate that there has been achieved the convergence by the criterion of small size or no change in the position of cluster centers. The maximum absolute change in the coordinates of any cluster is zero, which indicates the reliability of the calculations.

The factorized profile of the centers of the selected clusters, compiled on the basis of average values of factors in each of the selected clusters, is presented in Fig. 1.



**Fig. 1.** Factorized profile of the centers of the designated clusters

*Source:* created on the basis of the survey, conducted by the authors

The visualization of the clusters indicates their differences. According to the results of cluster analysis, 19 employers-respondents were included in the first cluster. It is characterized by high requirements of employers to the third factor («constantly improve qualification»), low assessment of the first factor («be able to prepare successful presentations» and «be able to work in a team») and a low assessment of the second factor («know new software products»; «speak 1-2 foreign languages»; «be able to conduct business negotiations»). The first cluster is recommended to interpret as «perfectionists».

The second cluster is the largest one, comprising 38 employers-respondents. The employers who represent this cluster focus on all three factors (requirements for graduates grouped into three factors): «partner-oriented», «advanced» and «pragmatic», namely, such requirements as: «be able to prepare successful presentations»; «be

able to work in a team»; «know new software products»; «speak 1-2 foreign languages»; «be able to conduct business negotiations»; «constantly improve qualification». The recommended name for this cluster – «maximalists».

The third cluster is represented by 23 employers-respondents. The most important requirements for the competencies of graduates according to the employers in this cluster are as follows: «know new software products»; «speak 1-2 foreign languages»; «be able to conduct business negotiations». These requirements are combined in the second factor. Not so important are such requirements for the competencies as the following: «be able to prepare successful presentations» and «be able to work in a team» (the first factor). There are low requirements of representatives of this cluster to the third factor - «constantly improve qualification». The recommended name for this cluster is «minimalists».

Descriptive characteristics of the clusters are presented in Table 6.

**Table 6.** Descriptive characteristics of the selected clusters

Characteristics	1 cluster of «perfectionists»	2. cluster of «maximalists»	3. cluster of «minimalists»
1. Percentage of respondents	23,75 %	47,5%	28,75%
2. Sphere of activity of enterprise	Production – 26%; trade – 16%; services – 58%	Production – 37%; trade – 8%; services – 55%	Production – 30%; trade – 22%; services – 48%
3. Organizational and legal form of enterprise	Private enterprise – 79%; business entity – 10,5%; state enterprise – 10,5%	Private enterprise – 68,4%; business entity – 13,2%; state enterprise – 18,4%	Private enterprise – 66%; business entity – 17%; state enterprise – 13%; entrepreneur – 4%
4. The most important requirements for the competencies of graduates	1. Analytical and forecasting skills on the basis of carried out research; 2. Focus on lifelong learning; 3. Combination of theoretical and practical skills that meet the specialty; 4. Ability to quickly adapt to professional environment	1. Analytical and forecasting skills on the basis of carried out research; 2. Ability to quickly adapt to professional environment; 3. Focus on lifelong learning; 4. Combination of theoretical and practical skills that meet the specialty	1. Ability to quickly adapt to professional environment; 2. Analytical and forecasting skills on the basis of carried out research; 3. Focus on lifelong learning; 4. Flexibility and psychological resistance to external influences.
5. The most important requirements for the personal qualities of graduates	1. Working efficiency 2. Creativity 3. Ability to learn in a workplace; 4. Discipline	1. Ability to learn in a workplace; 2. Ability to work in a team; 3. Communicative skills; 4. Working efficiency 5. Discipline and non-standard thinking	1. Communicative skills; 2. Ability to learn in a workplace; 3. Ability to work in a team; 4 Working efficiency 5.Emotional control
6. Internship abroad	Yes – 16%; No – 84%	Yes – 26,3%; No – 73,7%	Yes – 4%; No – 96%
7. Level of management	1. The lowest level – 21%; 2. Average level – 42%; 3. Top management – 37%	1. The lowest level – 5,2%; 2. Average level – 47,4%; 3. Top management – 47,4%	1. The lowest level – 8,7%; 2. Average level – 56,6%; 3. Top management – 34,7%
8. Gender	84,2% –women; 15,8% –men	52,6% –women; 47,4% –men	69,6% –women; 30,4% –men

Source: created on the basis of the survey, conducted by the authors

As can be seen from Table 6, the employers «maximalists» prevail in percentage. This can be explained by the fact that employers «maximalists» do not want to spend time and money on training, they want to get an energetic, hardworking employee who is ready to perform any task in the framework of his professional activities.

As the descriptive characteristics of clusters show, the set of the most important requirements for the competencies of graduates is almost the same in content, only their rating differs. However, the significance of the rating indicates the priorities of employers, which can be useful information for students of institutions of higher economic education even in the process of studying. Such information will allow graduates to orient themselves regarding the sphere of professional activity and will help to determine the choice of variable disciplines that form specific competencies. As a result, employers will be satisfied with the training of graduates; less time will be required to adapt graduates to professional environment. Employers will be able to set challenging tasks for graduates, the successful solution of which will enable graduates to ensure career growth and wage increase, will form dedication to the enterprise.

The «perfectionists» occupy almost equal shares among middle-level employers and top management. This group of employers is working on themselves, realizing that it is necessary for ensuring competitiveness in the market economy. They require «constant improvement of qualification» from others, as if «allowing» people of their own kind to remain in their professional environment. A rather large proportion of employers of the lowest level in the cluster are «perfectionists», not possessing high-level competencies themselves, since they work for a short period of time at the enterprise, they demand this from employees beginners, using the «power» of managers.

It is noteworthy that middle-level employers and top management are mostly «maximalists». They have different requirements for the competencies of graduates, probably taking into account the need to quickly adapt to changes in the labor market. Such employees, as the «maximalists» want to see, are easier to teach professions, since they have a complete set of competences, each of which can be used to the maximum, depending on the situation in business. Lower-level employers often realize their lack of professional experience, and therefore do not require much from graduates.

Middle-level employers dominate among the «minimalists». This, it can be assumed, is explained by the fact that they themselves are focused on «career growth». Any graduate with a wide range of competencies is perceived by them as a competitor, so they require a minimum of competencies from them. Top-management employers expect graduates to fulfill the role of a «performer», therefore such a list of competencies is sufficient for them. Lower-level employers «minimalists» did not adapt themselves sufficiently to the professional environment; therefore, they do not yet have professional ambitions towards graduates. All listed competencies are inherent in them.

Representatives of all three clusters singled out the ability «to learn in the workplace» among the most important requirements for the personal qualities of graduates. At the same time, the place in the rating of this personal quality is different. The «maximalists» consider «ability to learn in the workplace», «ability to work in a team» to be the most important personal qualities. This can be explained by global tendencies of lifelong learning, the fairly frequent use of the «brainstorming» method when making management decisions in situations of risk and unpredictability. In addition, the experience of internships abroad of employers-respondents belonging to the «maximalists» has become an incentive for such requirements for graduates.

The «perfectionists», representatives of the first cluster, among the most important requirements for the personal qualities of graduates placed emphasis on «working efficiency», «creativity» and «discipline». The presence of these qualities among graduates contributes to continuous self-study, improvement of qualification and performance.

The cluster of employers – «minimalists» consider «communication skills», «ability to work in a team», «working efficiency» and «emotional control» to be the most important requirements for personal qualities of graduates, which corresponds to the role of a «performer» assigned by them to graduates.

Every year, the Global Innovation Index ranks the innovation performance of nearly 130 economies around the world. The Global Innovation Index characterizes the innovative development of countries at different levels of economic development. The authors of the study (Global Innovation Index) believe that the success of the economy is connected both with the availability of the innovation potential and the conditions for its implementation. The index is calculated on the basis of 80 different variables, among which a significant proportion is occupied by such indicators as Human capital & research; Knowledge & technology outputs and Business sophistication.

Participants of World Economic Forum in Davos (Jahanian, 2018) expressed their point of view about the possible ways of transformation of higher education and mentioned that as the pace of discovery accelerates and global competition intensifies, universities must change, too. Universities must meet the challenges of the digital revolution head on and play an increasingly important role in our innovation ecosystems and economies in four key ways. 1. Fostering entrepreneurship. 2. Encouraging collaboration with the private sector. Universities must develop new partnerships with leading companies, foundations, and other research-intensive institutions. 3. Promoting diversity and inclusion. 4. Exploring the nexus of technology and society.

## **Conclusions**

The article further developed the definition of the prospects for innovations in marketing of economic educational services in Ukraine, which were identified on the basis of clustering of employers with regard to their requirements for the competencies of graduates of economic specialties that are important for «career growth». This will allow graduates to make the right choice of variable professional disciplines that form the competencies demanded by employers. Employers are encouraged to cooperate with institutions of higher education to obtain the expected qualified specialists. Together, meeting the needs of both parties will ensure the sustainability and improvement of the sphere of higher economic education and eliminate possible risks.

As a result of the conducted research, the authors offer the following prospects for innovations in marketing of economic educational services in Ukraine.

1. The possibility of restructuring the system of competencies in accordance with the expectations of employers in various areas of professional activity.
2. Expanding the choice of graduates of specialties in a particular field of activity due to the awareness of the real requirements of employers.
3. Formation of graduate «career growth» strategy for graduates when they are still at institutions of higher education. For example, in accordance with their own abilities, graduates choose the socially communicative professions of an advertiser, a PR manager, or an IT field etc.
4. Preparation of curricula taking into account the views of employers, which will ensure satisfaction of their expectations and the ability to meet the professional standards of each specific sphere of professional activity.
5. Formation of tactics of behavior among graduates based on the knowledge of customers in the labor market and their professional ambitions. An example, of such tactics can be «learn, while working» and «work, while learning». Depending on the scope of professional activity, preference is given to one of the tactics.
6. Expansion of labor markets for «graduates» who are oriented at employers «maximalists», with the possibility of entering the international market, which will allow them to be in demand and realize competences.
7. Obtaining the possibility of rapid «career growth» when contacting graduates with employers «perfectionists», since «constant improvement of qualification» will bear fruit and will allow them to achieve a higher status in the profession.

8. The increase of the segment of graduates who are focused on lifelong learning, because of the fear of being forced out from the labor market.
9. Encouraging students to consciously increase their knowledge and receive qualitative education, which will allow them to ensure their demand in the labor market, as the employers «maximalists» have excessive demands to the range of their competencies.

Further study of the dissonance and consonance of supply and demand, on the one hand, the competencies of graduates of economic specialties, and, on the other hand, the requirements of employers can be the basis for the development of new entrepreneurship areas. This will focus on the conformity of higher education with European standards, contribute to the formation of sustainable behaviors of the main participants in the interaction, which, as a result, will allow minimizing the existing problems both in the field of higher economic education and in entrepreneurship activities.

## References:

- Abramova, E. Y. (2016) Approach to model development in demand for graduates on the basis of segmentation of the labour market, *Innovations in management* 2(8): 15-17. Retrieved from: <https://elibrary.ru/item.asp?id=26369158>
- Al-Dulaimi Z. (2016). Education, Educational Services and their Quality, *Journal of Marketing Management* 4(1): 58-66. <https://doi.org/10.15640/jmm.v4n1a6>
- Ananishnev, V.M., (2015). Marketing of educational services: monograph. - Moscow: LTd SRC «Engineer » – T. 8. - 348 p. Retrieved from: <https://elibrary.ru/item.asp?id=23120838>
- Bejan, A.; Merkkx, G.B. (2007) *Constructal theory of social dynamics*. – Springer. – 350 p.
- Beryozka N. N., Krasilnikov T. V. (2016). Features of marketing of educational services: monograph. – Novosibirsk: NGPU. - 141 p. Retrieved from: <https://lib.nspu.ru/views/library/63634/read.php>
- Dudzevičiūtė, G.; Tvaronavičienė, M. (2011). Measurement framework of innovation activity: theoretical approaches' analysis, *Journal of Security and Sustainability Issues* 1(1): 63-75. [http://dx.doi.org/10.9770/jssi.2011.1.1\(6\)](http://dx.doi.org/10.9770/jssi.2011.1.1(6)).
- Dzemyda, I.; Zacharevič, G.; Nedelko, Z. (2015). Sustainability of international business through trade specialists' education, *Journal of Security and Sustainability Issues* 4(3): 564–574. DOI: [http://dx.doi.org/10.9770/jssi.2015.4.3\(6\)S](http://dx.doi.org/10.9770/jssi.2015.4.3(6)S)
- Etzkowitz, H., & Leydesdorff, L. (2000). The Dynamics of Innovation: From National Systems and «Mode 2» to a Triple Helix of University-Industry-Government Relations, *Research Policy* 29(2): 109-123.
- Fedulova, L. (2015). Marketing innovation: international context and practice of Ukrainian enterprises. In S.M. Illiashenko (Ed.), *Market-oriented management of innovation development: monograph*, – Kharkiv: LTd «Disa plus»: 329-339.
- Global Innovation Index. Retrieved from: [https://www.globalinnovationindex.org/userfiles/file/reportpdf/gii\\_2018-report-new.pdf](https://www.globalinnovationindex.org/userfiles/file/reportpdf/gii_2018-report-new.pdf)
- Grechkov, V. (2006). Factor analysis, *Laboratory of advertising, marketing and PR* 6(49). Retrieved from: <http://www.advlab.ru/articles/article452.htm>
- Igolkin, S.; Kuzmenko, N.; Shatalov, M. (2015). Private universities as a component of formation and functioning of educational clusters, *Professional Education in Russia and Abroad* 2(18): 55-60. Retrieved from: <https://cyberleninka.ru/article/n/negosudarstvennye-vuzy-kak-sostavlyayushchie-formirovaniya-i-funktsionirovaniya-obrazovatelnykh-klasteroev>
- Immaisi M. (2014). Productizing and Marketing of Educational Services for Export Case. Turku University of Applied Sciences. Master Thesis. – 74. Retrieved from: [https://www.theseus.fi/bitstream/handle/10024/77372/Immaisi\\_Marjukka.pdf?sequence=1](https://www.theseus.fi/bitstream/handle/10024/77372/Immaisi_Marjukka.pdf?sequence=1)
- Illiashenko, S. (2016). Innovative development: marketing and management of knowledge: monograph. – Sumy: LTd «Disa plus». – 192 p. Retrieved from: [https://essuir.sumdu.edu.ua/bitstream/123456789/45520/1/Illiashenko\\_Innovative\\_2016.pdf](https://essuir.sumdu.edu.ua/bitstream/123456789/45520/1/Illiashenko_Innovative_2016.pdf)



Illiashenko, S. (2016). Digital marketing in higher education. In O.V. Prokopenko (Ed.), Marketing of educational services: monograph. – Ruda Śląska: «Drukarnia i Studio Graficzne Omnidium»: 79-88. Retrieved from: <http://essuir.sumdu.edu.ua/handle/123456789/49017>

Išoraitė, M.; Steiblienė, L.; Mečėjienė, G. (2014). If obtained professional competences are suitable for sustainable entrepreneurship: case of Vilnius University of Applied Sciences, *Entrepreneurship and Sustainability Issues* 1(4): 239–246. [http://dx.doi.org/10.9770/jesi.2014.1.4\(6\)](http://dx.doi.org/10.9770/jesi.2014.1.4(6))

Jahanian F. (2018) 4 ways universities are driving innovation. Key moments from World Economic Forum Annual Meeting. Retrieved from: <https://www.weforum.org/agenda/2018/01/4-ways-universities-are-driving-innovation/>

Kotler P., Fox K. (1995). *Strategic marketing for educational institutions*. Englewood Cliffs., N.Y. Prentice Hall. – 484 p.

Kravtsov, P.G., Mikhalkovich, V.N. (2015) Organizational-methodical bases of the functionally oriented training of specialists in the structure of regional educational cluster, *Vestnik of Samara State Technical University Series: Psychological and pedagogical sciences* 2(26): 99-107. Retrieved from: <http://vestnik-pp.samgtu.ru/uploads/series/1/39/2015-2-26.pdf>

Lavrinenko, O.; Ohotina, A.; Tumulavičius, V.; Pidlisna, O.V. 2016. Assessment of partnership development in cross-border regions' innovation systems (Latvia-Lithuania-Belarus), *Journal of Security and Sustainability Issues* 6(1): 155–166. [http://dx.doi.org/10.9770/jssi.2016.6.1\(12\)](http://dx.doi.org/10.9770/jssi.2016.6.1(12)).

Laužikas, M.; Dailidaitė, S. 2013. Benefits of social capital for sustainable innovation capabilities, *Journal of Security and Sustainability Issues* 2(3): 85–97. [http://dx.doi.org/10.9770/jssi.2013.2.3\(7\)](http://dx.doi.org/10.9770/jssi.2013.2.3(7))

Martynenko, M.V.; Lysytsia N.M.; Prytychenko T.I. (2018). Innovations in marketing of economic educational services, *Scientific bulletin of Polissia* 2(14). Ч. 2: 212- 220. [http://dx.doi.org/10.25140/2410-9576-2018-2-2\(14\)-212-220](http://dx.doi.org/10.25140/2410-9576-2018-2-2(14)-212-220)

Porter M.; Ketelhohn N.; Artiganave A.; Kelly J.; Krasniqi, M.; Gi, M. T. P.; Zhang L. (2010). The Massachusetts Higher Education and Knowledge Cluster: The Microeconomics of Competitiveness. – USA: Massachusetts Press, Retrieved from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.570.1788&rep=rep1&type=pdf>

Prokopenko, O.V. et al. (2016). Marketing of educational services: monograph. – Ruda Śląska: «Drukarnia i Studio Graficzne Omnidium». – 168 c. Retrieved from: [https://essuir.sumdu.edu.ua/bitstream/123456789/59120/1/Marketing\\_2016.pdf](https://essuir.sumdu.edu.ua/bitstream/123456789/59120/1/Marketing_2016.pdf)

Punj, G.; Stewart, D.W. (1983). Cluster Analysis in Marketing Research: Review and Suggestions for Application, *Journal of Marketing Research* Vol. XX: 134-148. Retrieved from: [https://www.researchgate.net/publication/329631245\\_Cluster\\_Analysis\\_in\\_Marketing\\_Research\\_Review\\_and\\_Suggestions\\_for\\_Application](https://www.researchgate.net/publication/329631245_Cluster_Analysis_in_Marketing_Research_Review_and_Suggestions_for_Application)

Rai, M.A.; Raguraman, M.; Veerappan, R. (2013). Marketing of Educational Services. A New Strategy for Customer Satisfaction, *International Journal of Scientific Research and Management* 1(8): 435-440. Retrieved from: <https://ijsrm.in/index.php/ijsrm/article/view/198>

Semchuk, Zh. V. (2017). Marketing of educational services enterprises in the conditions of economic instability with the risk-based, *International scientific journal «Internauka»* 1(23): 120-126. Retrieved from: [http://nbuv.gov.ua/UJRN/mnj\\_2017\\_1%282%29\\_26](http://nbuv.gov.ua/UJRN/mnj_2017_1%282%29_26)

Senan, N.A.M. 2018. Developmental review program impact on enhancing the effectiveness of "Teaching and Learning" in accounting program: a case study in a Saudi University, *Entrepreneurship and Sustainability Issues* 6(2): 1001-1017. [http://doi.org/10.9770/jesi.2018.6.2\(35\)](http://doi.org/10.9770/jesi.2018.6.2(35))

State Statistics Service of Ukraine, 2019. Demographic and social statistics/Education. Retrieved from: [http://www.ukrstat.gov.ua/operativ/menu/menu\\_u/osv.htm](http://www.ukrstat.gov.ua/operativ/menu/menu_u/osv.htm)

Tierney, W. G.; Lanford, M. (2016). Conceptualizing innovation in higher education. In M. B. Paulsen (Ed.), Higher education: Handbook of theory and research, vol. 31 (pp. 1-40). Dordrecht: Springer. [https://www.researchgate.net/publication/303208037\\_Conceptualizing\\_Innovation\\_in\\_Higher\\_Education](https://www.researchgate.net/publication/303208037_Conceptualizing_Innovation_in_Higher_Education)

United Nations Development Programme (2018). Human Development Indices and Indicators 2018: Statistical Update. Retrieved from: [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)

United Nations Development Programme (2016). Human Development Report (2016). Human Development for Everyone. Retrieved from: [http://hdr.undp.org/sites/default/files/2016\\_human\\_development\\_report.pdf](http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf)

United Nations Development Programme (2015). Human Development Report. (2015). Work for Human Development. Retrieved from: [http://hdr.undp.org/sites/default/files/2015\\_human\\_development\\_report\\_0.pdf](http://hdr.undp.org/sites/default/files/2015_human_development_report_0.pdf)

Ximena, Del Carpio; Kupets, Olga; Muller, Noël; Olefir, Anna. (2017). Skills for a Modern Ukraine. Directions in Development. Washington, DC: World Bank. <https://doi.org/10.1596/978-1-4648-0890-6>.

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## ASSESSMENT OF FOREST ENTERPRISES' PERFORMANCE: INTEGRATING ECONOMIC SECURITY AND ECOLOGICAL IMPACT\*

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**Abstract.** At the stage of the strategic or tactical managerial decisions justification, it is important to choose the right approach, verify proper information sources, develop methods to identify the status of the enterprise. The mentioned prerequisites necessitate the development of methodological tools for the formation of appropriate information and analytical support. The *aim* of the study is to substantiate the methodology of assessing the ecological and economic security of forestry farms and to test this methodology basing on the data received from state forestry enterprises. The *subject* of the study is the methodological aspects of developing the methodic for assessing the ecological and economic security of forests, taking into account the peculiarities of their functioning as complex ecological-economic systems. The latter determines the essence of the hypothesis, which requires the use of an integrated indicator for assessing the security of forestry enterprises, taking into account interdependent and interconnected economic and environmental components. Methodic for assessing the ecological and economic security of forest holdings is a sequence of stages that ensure the formation of an information base for the research; selection of indicators; their processing using component, index, normative methods; interpretation of the results of calculations. The authors specify the content of the main terms: ecological, economic, financial, techno-technological, social security, safety of forest use, reforestation, forest protection activity. The methodic has been tested on the data from forest enterprises in Volyn and Rivne regions of Ukraine. The authors obtained adequate results, which indicate a high and satisfactory level of ecological and economic security of these enterprises in 2017. The strengths and weaknesses of the enterprises and the factors that influenced them were revealed. The methodology for assessing ecological and economic security is a tool for obtaining the necessary information about the status of the enterprise in order to substantiate practical recommendations for the further development of forestry as a coherent and stable system.

**Keywords:** assessment; ecological and economic security; forest resources; forestry

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**Additional disciplines:** ecology and environment

## 1. Introduction

The current state of affairs in the world economy can be classified as openly anthropocentric. Consumer attitudes towards economic growth and macroeconomic equilibrium have become the cause of antagonisms in the system of "society – nature". In connection with this, the last decades have been marked with the intensive development of new scientific fields such as environmental economics, economics of natural resources, sustainable development economics, "green" economics, which form a modern view of the principles, forms and directions of enterprises development, economic spheres of activity, for individual territories and society in general in order to ensure economic and environmental security. The latter involves the development of methodological foundations for the study of the status of enterprises applying the aggregated criterion of ecological and economic security.

The need to develop methodological approaches to assessing the ecological-economical security of forestry enterprises is particularly urgent since their economic activity is based on the use of forest resources and includes very specific activities such as forest growing, reforestation and forest protection.

In our research, the essence of ecological-economic security of an enterprise is considered as a state of its protection from negative influences due to internal stability, self-identity, integrity, flexibility and adaptability, which provides the ability for stable development, realization of the set goals, achievement of desirable results without harm to the environment, preservation of resource and assimilation potential of the environment.

Ecological security in the enterprise management system should be considered as a criterion for making strategic decisions regarding a number of factors: ensuring compliance of all enterprise's operation aspects with the requirements of the current environmental legislation and national and international environmental standards; provision of ecological rehabilitation and reproduction of disturbed forest ecosystems; use of environmentally sound technologies; training of specialists who take ecologically-motivated management decisions; application of ecological management in the system of enterprises management; formation of an effective system of informational and analytical support for environmental safety management.

The aim of the study is to elaborate and substantiate the methodology of assessing the ecological and economic security of forest holdings. To achieve this goal, the following tasks are set: to review the existing approaches to assessing the economic and environmental security of the enterprise; clarify the conceptual apparatus of the research; to develop a methodology for assessing the ecological and economic security of forest enterprises; to carry out its testing; comment on the results.

## 2. Scientific sources review

The joined concept of ecological and economic security has not been studied. Most works are dedicated either to economic or environmental security separately. Environmental security is often considered as a component of the national security, and the research concerns certain spheres of activity (nature use, separate technologies,

enterprises, directions of economic activity, regions), therefore methodological approaches to the evaluation differ significantly.

In particular, the researchers of the Institute of Natural Resources and Sustainable Development of the National Academy of Sciences of Ukraine (Khvesik et al., 2014) elaborated the scientific basis for the study, carried out a comprehensive analysis and evaluation, grounded the strategic directions of ensuring ecological, natural and technogenic security of Ukraine and its regions in the context of European integration processes; defined priorities and developed financial and economic mechanisms for ensuring environmental security at the regional level.

A. Kubaenko (2018) considers the conditions and scenarios of changes in the national economy as a result of European integration in the context of Ukraine's economic security revitalization. N. Ilysheva, E. Karanina and others (2017) devoted their work to revealing the interdependence of economic development and environmental indicators in industry. L. Nikolenko, E. Jurakovskiy and others (2018) investigated the role of the managing investment policy of the Ukraine's agrarian sector economic security on the basis of the theory of fuzzy logic. V. Bogdanov, N. Ilysheva and others (2016) proposed a model for the ratio of economic development and environmental indicators using enterprise's non-financial reporting data. V. Artyushok (2012) has developed the criteria for the forestry enterprise's activities compliance with the strategic mission and the objectives that determine the environmental, economic, and social sustainability.

The methodology by S. Dovbnya, N. Gichova (2008) diagnoses the level of current security by identifying the bankruptcy symptoms based on the assessment of the financial and economic status of the enterprise in terms of financial independence, asset liquidity, cash flows, business activity and profitability of the enterprise. V. Prypoten (2013) proposed an approach to assess the threats to the ecological and economic security of an industrial enterprise on the basis of comparison of possible losses from the ecological-economic risk with marginal levels of risk. M. Domashenko et al. (2014) developed an approach to assessing the level of environmental and economic security of the enterprise's foreign economic activity on the basis of a comprehensive indicator that takes into account the value of the enterprise's potential for foreign economic activity, the level of country risk when entering the external market, the level of market opportunities of the enterprise, and the environmental friendliness of foreign economic activity. L. Hromushyna (2011) developed an integral-criterion indicator of the ecological and economic security of agricultural enterprises development, which envisages economic, ecological and social criteria for assessing the level of agricultural enterprises' security in points, allowing to refine the factors that determined the result. M. Nikitina et al. (2018) apply a systematic approach to the analysis of the impact of investment activity on economic security; offered indicators of the investment component in economic security. A. Kuklin, L. Kuklina, I. Korobkov (2018) developed criteria for the diagnostics of region's eco-economic security. J. Tagiltseva, N. Drozdov (2017) substantiated the indicators monitoring socio-ecological-economic security of management environmental.

J. Zemguliene, M. Valukonis (2018) conducted an analysis of scientific literature by the structured literature review method to identify business processes effective tools and methods of assessment and evaluation. J. Narkunienė, A. Ulbinaitė (2018); S. Hilkevics, V. Semakina (2019) studied and compared modern evaluating methods of the company's performance, and concluded that it was necessary to create a multi-criteria indicator evaluation method. A. Bilbao-Terol et al. (2019) had substantiated the need for multi-criteria methodology to integrate the corporate social responsibility assessments and companies' financial indicators in a unique dimension of global sustainability productivity; M. Yevdokimova et al. (2018), A. Hasanudin et al. (2019) have considered similar multi-criteria methodology on the basis of sustainable development.

The study of scientific works allowed to make a number of generalizations.

1. The main approaches that can be used to assess ecological and economic security are:

- indicator based, relies on a system of indicators which describe the status of various components and levels of ecological and economic security;
- resource based, where the main criterion for assessing ecological and economic security represents the efficiency of existing resources usage by the enterprise;
- efficiency based, where the main criteria are to reduce costs and losses, increase profitability;
- systemic, which allows to combine all the above, but has a significant advantage as a research tool, since it allows to consider ecological and economic security as a complex holistic system, to identify internal and external links, developmental problems.

2. The reliability of approaches to the assessment of ecological and economic security can be determined on the basis of criteria selected as the initial indicators, assessing the qualitative and quantitative parameters of the objects under study. Among such criteria are: general economic effect, level of profitability, financial independence and solvency; security of basic business processes; the level of competitiveness, an integral security criterion, which includes the most important resource components of the enterprise, the stability of ecosystems.

3. The most commonly used methods of assessing the ecological and economic security of an enterprise are: component (involves identifying factors that affect the level of environmental and economic security of the enterprise); index (allows you to apply different indicators in one set); expert; comparison based (comparison of the values of individual groups of similar security indicators among themselves); normative; estimated (provides a quantitative assessment of ecological and economic security on the basis of a system of indicators obtained both theoretically and empirically).

4. These methods are basic for assessing the level of economic security. Despite the differences in application of different systems of indicators, the fundamental difference is determined by the criterion underlying the methodology.

Scientific works analysis has shown that in each method of economic or environmental security study, the researchers should take into account the specifics of a particular sphere, the direction of activity, various aspect of security, the level of the object under research. Therefore, there is a need for the development of existing findings, taking into account the specifics of the forest holdings functioning.

### 3. Clarification of the conceptual apparatus

The study of various approaches to the definition of the economic entity's security, allows for the following generalizations: most often it is considered as a status of the enterprise; the result of effective management activity; condition of stable development. For the basis of this research we will adopt the following interpretation of the ecological and economic security: the internal ability of the object to withstand the threats, ensuring the realization of their own interests and goals while preserving the existing or achieving the desired parameters, without causing damage to other objects in the short and long term; a result of dedicated activity to preserve its identity, integrity, qualitative parameters and ability to purposeful development (L. Cherchyk, 2016).

The meaningful content of the ecological and economic security of the company is defined by its components, for the purpose of the specification, a functional approach has been applied. In our opinion, the economic security of forestry is most influenced by financial, technical and technological, social, nature-resource factors, which respectively form the financial, technical, technological, and social. We consider the financial security of an enterprise as its financial condition characterized by sufficient amounts of financial resources to provide effective and sustainable development. Technical and technological security is the status of production process' technical and technological component protection, which creates conditions for efficient and rational use of technics and



technology, their updating in order to ensure a high level of enterprise's competitiveness.

We consider the social component of the enterprise's economic security as a level of social and labor relations development, which ensures the interests of employees and the enterprise (its owners), achievement of the of professional and personal development goals on the basis of mutually beneficial partnerships, ensuring an adequate standard of living, income, working conditions etc.

Ecological security becomes especially relevant for environmental enterprises, since their economic efficiency in the long run is largely determined by the environmental policy of the enterprise, implementation of the principles of non-exhausting and reproducible use of forests. Its main components are forestry security, forest rehabilitation, forest protection. The essence of forest use security can be formulated as a state of ensuring the economic activity of the enterprise with natural resources, which allows achieving the goals of development in the conditions of their rational use. Forest regeneration security is determined by the faster pace of artificial and natural reforestation of forest areas in comparison with the rates of forest cutting. The security of forest protection activities relies on the ability to preserve the quality of the forest ecosystem in which the enterprise operates (A. Cherchyk, 2016).

#### 4. Research methodology

The ecological and economic security assessing methodology includes the following steps:

- 1) definition of indicators' groups to be included in the assessment;
- 2) definition of approaches to indicators standardization;
- 3) standardization of indicators for the purpose of transition to indices (for each group);
- 4) determination of approaches to the calculation of group indexes;
- 5) assessment of the ecological and economic security of the enterprise by its main components (groups of indicators);
- 6) determination of the integral index of ecological and economic security;
- 7) formation of a scale of ecological and economic security levels;
- 8) determination of the level of ecological and economic security on the established scale;
- 9) interpretation of the results of the evaluation, verification of their reliability and formulation of conclusions.

As it was noted, the main groups of indicators are: financial, technical and technological, social, forest resources restoration and use, forest protection activities. Consequently, the assessment of the company's environmental and economic security implies the use of the hierarchical system of indicators: local (unit), group, integral, presented in Table 1.

**Table 1.** Indicators for assessing the economic security of forest holdings

Group	Single Indicators	Formula of calculation
Financial security	Absolute liquidity ratio	Cash / current liabilities
	Turnover rate of current assets	The ratio of net income from sales to the value of current assets
	Coefficient of financial stability	The ratio of own funds to borrowed
Technical and technological security	Fixed assets suitability ratio (FA)	Amount of FA wear / initial value of FA by the end of the year)
	Material return	The ratio of net income from sales to the amount of material costs
	Return on assets	The ratio of the cost of products to the annual average cost of FA
Social security	Coefficient of the staff's material needs satisfaction	The ratio of the average monthly salary of an employee to its minimum level in the country
	Personnel stability factor	Fluidity coefficient (the ratio of the number of abandoned

		workers due to disrespectful reasons to the average number of staff members)
	Rate of security from injuries and occupational diseases	The ratio of the number of workers who received injuries and the diagnosis of occupational disease due to harmful working conditions to the average number of employees
Forest Resources Recovery Indicators	Indicator of artificial reforestation	The share of artificial reproduction of forest areas in the total felling area
	Indicator of natural reforestation	The share of natural forest renewal in the total felling area
	Forest care indicator	The share of care cuttings in the total felling area
Forest Resources Use Indicators	Coefficient of actual use of the estimated forest sector	The ratio of the actual volume of harvested wood to the volume of the established felling area
	Indicator of output of harvested liquid wood within the limits of main use cuttings, cubic meter. m / ha	The ratio of volumes of harvesting of liquid wood to the area of cutting of the main use
	Coefficient of cutting of the main use	The ratio of the area of the main cuttings to the total felling area
Indicators of forest-protective activity	Indicator of loss of timber due to illegal logging	The ratio of illegal felling (in cubic meters) to the estimated forest felling area
	Indicator of loss of wood due to fires	The ratio of burned and damaged forest (in cubic meters) to the estimated forest area
	Indicator of forests revitalization	The share of sanitary felling in the total felling area

Source: Developed by A. Cherchyk (A. Cherchyk, 2016).

We propose the standardization of individual indicators as the definition of comparative indices within each subgroup. For indicators-stimulants, the index is calculated by the formula:

$$I_{nc} = X_i / X_{max}, \quad (1)$$

where  $X_i$  – i-is a value of the indicator in the sample;

$X_{max}$  – maximum value of the indicator in the sample.

For indicators of disinfestation, namely the indicator of loss of wood due to illegal logging and the loss of wood due to fires, the index is calculated by the formula:

$$I_{nd} = 1 - X_i, \quad (2)$$

where  $X_i$  – i-is a value of the indicator in the sample.

Such an approach ensures the transformation of disinfectant indicators into a positive status, which allows us to calculate the total index of forest activities security. Logically, if  $X_i = 0$ , the index is taken equal to 1, because there was no negative event. The model for determining the integral indicator of ecological and economic security will be as follow: the group indices are defined as the sum of the individual, divided by their number; Integral index of ecological and economic security of an enterprise is defined as the sum of groups, divided by their number.

Interpretation results of the evaluation involve the transfer of quantitative indicators to qualitative security features (high, sufficient, low, critical). The higher is an integral index value, the higher is the level of ecological and economic security of the enterprise. Based on Harrington's desirability function, the threshold values of the levels of ecological and economic security are set forth. Harrington's classic scale provides for the allocation 5 levels attribute quality: very high 1,00-0,81; high 0,80-0,64; sufficient 0,63-0,38; low 0,37-0,21; critical 0,37-0,21; S. Dovbnya, N. Gichova (2008) applied the scale of the four levels that we took as a basis (Table 2).

**Table 2.** The scale of indices intervals for the levels of the enterprise's ecological and economic security

The level of ecological and economic security of the enterprise	Indicators Value
High	1-0,75
Sufficient	Less than 0,75 till 0,5
Low	less than 0,5 till 0,25
Critical	less than 0,25

*Source:* Developed on the basis of Harrington's desirability function (Harrington, E. C., 1965; Dovbnya, S., Gichova, N. 2008).

Therefore, the developed methodology allows determining the level of ecological and economic security of the enterprise in general and in terms of its components, which will enable to identify weaknesses and effective tools for managing ecological and economic security.

### 5. The approbation of the methodology for assessing the ecological and economic security of forest holdings. Results. Comments.

The approbation of the methodology for assessing ecological and economic security was carried out on the data from two forest farms in Volyn region (state enterprise "Kamin-Kashyrsk forestry", SE "Manevychi forestry") and two in Rivne region (SE "Klesiv forestry", state enterprise "Sosniv forestry").

The main criteria for choosing forest holders were the area and forest cover of their territory, since, in our opinion, these are objective indicators for the development opportunities of these enterprises, which determine the starting conditions for economic activity. The mentioned companies have the largest area (about 50 hectares) and forest areas (30-36%) among forestry enterprises in these regions.

The forests of these state forestry enterprises are located within the Northern geographical and climatic zone of Ukraine and on the border of the transition to the forest-steppe. The main species are Scots pine, oak, English oak, birch. In addition, forest crops of black spruce and alder, birch and Northern oak are being developed. The main activities of forestry enterprises are reforestation, forestry and logging; provision of services in forestry; sawmill and production planing, wholesale trade in wood. Economic activity of these enterprises is aimed at rational and efficient use of forest resources, as well as maintenance and improvement of soil protection, sanitary and hygienic, health, aesthetic and useful functions of the forest.

More than 60% of the forestry products are exported. In actual prices in percent of the total amount in Ukraine the production volume of forestry constitute: in Volyn region – 6%, in Rivne region – 14%.

Output data which described activities of the forestry and are used to calculate ecological and economic security are displayed in Table 3.

**Table 3.** Criteria for selection of forestry enterprises to assess the level of ecological and economic security

Forestry indexes	Kamin-Kashyrsk	Manevychi	Klesiv	Sosnivsk
Area of land permanent use, thousand, ha	49,9	52,2	54,6	49,8
Cash, thousand hrn	46	7973	4040	3685
Current liabilities, thousand hrn	10143	7049	6510	12039
Net income from sales, thousand hrn	62611	124735	231345	126267
Value of current assets, thousand hrn	7378	16872	6601	5332
Own funds, thousand hrn	9531	38101	18718	8174

Borrowed, thousand hrn	10194	8518	14822	17013
Cost of fixed assets, thousand hrn	8817	28011	26569	17943
Amount of material costs, thousand hrn	13952	24298	95734	43637
Average number of staff members, persons	176	421	517	470
Average monthly salary of an employee, thousand hrn	7,914	9,1	12,587	9,523
Total felling area, hectares	2119	2571	2829	2037
Artificial reproduction of forest areas, hectares	157	253	459	479
Area of the natural renewal of the forest, hectares	251	409	414	97
Actual volume of harvested wood	106628	156830	166472	157874
Illegal felling, cubic metres	29	52	286	40
Area of the main cuttings, hectares	147	383	379	230
Volume estimated forest felling area, cubic metres	45340	89230	78800	64180
Volumes of burned and damaged forest, cubic metres	0	0	0	0
Area of sanitary felling, hectares	1504	1731	1643	1087
Net profit, thousand hrn	193	4631	1765	1523

Source: According to the company's reporting documentation.

The data for assessing the ecological and economic security of forest enterprises is based on the reporting documentation. The evaluation results are shown in Table 4.

**Table 4.** Indicators of ecological and economic security of forest farms in 2017

Indexes	Kamin-Kashyrskyi	Manevycke	Klesivske	Sosnivske
Indicators of financial security				
Absolute liquidity ratio	0,005	1,131	0,621	0,306
Turnover rate of working capital	8,486	7,393	35,047	23,681
Coefficient of financial stability	0,944	4,473	1,263	0,480
Indicators of technical and technological security				
Fixed assets suitability ratio	0,49	0,478	0,44	0,57
Return on assets, ths. UAH	6,39	4,387	7,89	7,30
Material return, ths. UAH	4,49	5,13	2,42	2,89
Forest holdings social security indicators				
Coefficient of staff's material needs satisfaction	2,473	2,844	2,7	2,976
Personnel stability factor	0,784	0,86	0,8	0,655
Rate of safety from injuries and occupational diseases	1	1	1	0,998
Indicators of forest resources restoration				
Indicator of artificial reforestation	0,074	0,098	0,162	0,235
Indicator of natural reforestation	0,118	0,159	0,146	0,048
Forest care indicator	0,212	0,111	0,280	0,292
Indicators of forest resources use by forest enterprises				
Coefficient of the estimated actual use of the forest sector	0,634	0,875	0,930	0,863
Indicator of the harvested liquid wood output within the limits of main use fellings, cubic meter. m / ha	195,69	203,83	193,30	265,60
Coefficient of fellings of main use	0,069	0,149	0,134	0,113
Indicators of forest protection activities by forest enterprises				
Indicator of timber loss due to illegal logging	0,0006	0,0006	0,0036	0,0006
Indicator of timber loss due to fires	0,0000	0,0000	0,0000	0,0000
Indicator of forests improvement	0,710	0,673	0,581	0,534

Source: Calculations A. Cherchuk.

The absolute liquidity ratio should be in the range of 0,2-0,35, the optimal value was observed only in Sosnivsk forestry. In the Kamin-Kashyrsk region, this indicator was significantly lower than the normative value meaning

that enterprise is not able to liquidate short-term debt at the expense of cash; in Manevychi and Klesiv forestries the indicator is much higher than normative value. Turnover of circulating assets is low, which can be explained with peculiarities of forestry business. The value of financial stability ratios should be higher 1; the financial status of Klesiv and Manevychi forest enterprises was stable, and in other two cases it was not.

The technical condition of the main production assets by the coefficient of fitness is low due to the expiration of the normative term of use. Return on assets is low throughout the industry. Of the enterprises under investigation, the best indicators are in Klesiv forestry. However, the material output of products is also low, which indicates the inefficient use of harvested forest resources.

The coefficient of staff's satisfaction with material needs, which indicates how many times the wages of forestry employees are higher than the minimum, was the highest in the Sosnivsk forestry. The staff stability rate is high enough, despite the seasonality of the work, which involves the adoption, and then the release of staff, mostly labor workers. The security of working conditions in the most critical form is characterized by the indicators of injuries and occupational diseases due to the influence of negative productive factors. In most of the forest enterprises, the security factor from injuries and occupational diseases was 1, which indicates the absence of the latter. One traumatized worker was reported by Sosnivsk forestry.

The Indicator of artificial reforestation characterizes the level of the total area of felling coverage thanks to the planting and sowing of the forest. In the analyzed period, it is low in all forestry enterprises and is, on average, 15-20%. The indicator of natural reforestation characterizes the level of the total area of felling coverage by means of natural regeneration of the forest promotion. This indicator was higher than the artificial restoration index in Kamin-Kashyrsk and Manevychi forestry's. In sum, these types of works ensure the reproduction of forests by 25-30%. The indicator of forest care characterizes the share of cuttings, desalination, landscape formation, etc. in the total areas of felling. These works contribute to the creation of conditions for better growth and the formation of forest stands. The indicators are quite high and indicate a large amount of work on forest care. They cover an average of 30% of the total felling area.

Indicators of the forest resources use by the forest enterprises, characterizes the productivity of logging activities in natural terms. The coefficient of actual use of the estimated forest plot indicates its almost full use in the Klesiv forestry. The lowest indicator is in Kamin-Kashyrsk forestry. The rate of harvested liquid wood output within the framework of the main use was the lowest in the Klesiv forestry, and the highest is Sosnivsk forestry. The main use cutoff factor, which characterizes their share in the total volume, was the largest and accounted for almost 15% in Manevychi forestry.

Indicators of forest protection activities by forest enterprises, contains two indicators of ecological-economic security stimulants (loss of wood, loss of forest stands), and the index of forests improvement. As we see, there were no significant losses from illegal logging and fires. The worst situation was due to the loss of timber due to illegal logging in Kamin-Kashyrsk forestry in 2015, Olevsk – in 2016-2017, Klesiv – in 2017. As a result of fires, Kamin-Kashyrsk forestry in 2015 achieved the largest loss of wood, Manevychi – in 2015, Klesiv – in 2014. Indicators for improving the forests were very different even in some forest farms within five years. In particular, in Kamin-Kashyrsk forestry this indicator ranged from 0,249 in 2015 to 0,710 in 2017, Manevychi – from 0,175 in 2015 to 0,673 in 2017. The most stable and high indicators were in Nizhyn and Klesiv forestries.

Indices of forestry companies' ecological and economic security indicators for 2017 are shown in Table 5.

**Table 5.** Indices of forestry companies ecological and economic security indicators in 2017

Indexes	Kamin-Kashyrskyi	Manevycke	Klesivske	Sosnivske
Indices of financial security				
Absolute liquidity ratio	0,004	1,000	0,549	0,271
Turnover rate of working capital	0,242	0,211	1,000	0,676
Coefficient of financial stability	0,211	1,000	0,282	0,107
Indicators of technical and technological security				
Fixed assets suitability ratio	0,860	0,839	0,772	1,000
Return on assets	0,810	0,556	1,000	0,925
Material return	0,875	1,000	0,472	0,563
Forest holdings social security indicators				
Coefficient of staff's material needs satisfaction	0,831	0,956	0,907	1,000
Personnel stability factor	0,912	1,000	0,930	0,762
Rate of security from injuries and occupational diseases	1,000	1,000	1,000	0,998
Indicators of forest resources restoration				
Indicator of artificial reforestation	0,315	0,417	0,689	1,000
Indicator of natural reforestation	0,742	1,000	0,918	0,302
Forest care indicator	0,726	0,380	0,959	1,000
Indicators of forest resources use by forest enterprises				
Coefficient of the estimated actual use of the forest sector	0,682	0,941	1,000	0,928
Indicator of the harvested liquid wood outputf within the limits of main use fellings, cubic meter	0,737	0,767	0,728	1,000
Coefficient of fellings of main use	0,463	1,000	0,899	0,758
Indicators of forest protection activities by forest enterprises				
Indicator of timber loss due to illegal logging	0,999	0,999	0,996	0,999
Indicator of timber loss due to fires	1,000	1,000	1,000	1,000
Indicator of forests improvement	1,000	0,948	0,818	0,752

Source: Calculations by A. Cherchyk.

The results of the indices calculations indicate their significant differences in the structure of financial security of forests and the restoration of forest resources.

The calculation results of the group and integral indices of ecological and economic security are reflected in the table 6.

**Table 6.** Calculation results for the group and integral indices of ecological and economic security in specified forestries in 2017

Indexes	Kamin-Kashyrskye	Manevycke	Klesivske	Sosnivske
Financial security group index	0,153	0,737	0,610	0,351
Technical and technological security group index	0,848	0,798	0,748	0,830
Social security group index	0,914	0,985	0,946	0,920
Forest resources renewal group index	0,594	0,599	0,856	0,767
Forest resources use group index	0,627	0,903	0,876	0,895
Forest protection activities group index	0,999	0,982	0,938	0,917
Integral index of ecological and economic security	0,689	0,834	0,829	0,780

Source: Calculations by A. Cherchyk.



The level of financial security in the Kamin-Kashyrsk region was critical; in Manevychi and Klesiv forestries it was sufficient, and in Sosnivsk forestry it was low. The level of technical and technological security of forest holdings is high. In our opinion, this is due to the same type of provision of forestry facilities by main means, their approximately the same structure, the same rate of wear. This led to a low discrepancy in the indicators, and hence high indices. The level of social security is steadily high. This is due to relatively high wages, low levels of injuries and satisfactory working conditions.

The Group Forest Resources Recovery Index shows a high level of security in the Klesiv and Sosnivsk forestries and satisfactory levels in Kamin-Kashyrsk and Manevychi forestries. The Group Forestry Use Index indicates a high level of security in all, except for Kamin-Kashyrsk forestries, where it was satisfactory. This result is due to small differences in actual data on logging, as well as a fairly high level of productivity of logging operations. Group indices of forest protection activity at all forestry enterprises were high. In 2017, the integral index of ecological and economic security showed a high level in Manevychi, Klesiv, Sosnivsk forestries, and satisfactory level at Kamin-Kashyrsk forestry.

Thus, approbation of the methodology allowed to determine the integral level of ecological and economic security of enterprises in general and in terms of its components, which makes it possible to identify the strengths and weaknesses in terms of enterprises' activities. The obtained results can be used to substantiate the strategy of providing ecological and economic security of the enterprise and substantiate tactical management decisions.

### ***Acknowledgments***

*The research was performed within the scientific researches framework "Management of socioecological and economic security" (state registration number 0117U002302) conducted at Lesia Ukrainka Eastern European National University.*

### **Conclusions**

The achievement of the enterprise development goals depends to a large extent on the correctness of the chosen strategy, the effectiveness of its implementation, the timeliness of making managerial decisions to adjust the strategy. At the stage of the strategy or tactical managerial decisions justification, it is important to choose the right approach, sources of information, methods of its processing in order to identify the status of the enterprise. This is ensured by assessing the company's ecological-economical security in order to provide early warning and response to changes and further adjusting actions, developing measures to prevent the development of negative changes.

An overview of existing scientific approaches to assessing the ecological and economical security of an enterprise indicates that they vary significantly, depending on the research objectives, the scope of the company's operation, the established criteria and development priorities. It is established that the main approaches are indicative, resourceful, productive, and systemic. Thus researchers use corresponding methods of evaluation such as component, index, expert, comparison, normative, estimated. In the elaborated techniques several of these methods are combined.

Forestry enterprises have a distinct specificity of functioning, since they combine economic activity based on the use of woody and non-woody forest resources, forestation, reforestation and forest protection. Thus it was necessary to take into account these features in determining the components of ecological-economical security and indicators of its evaluation.

To elaborate the methodology of assessing the ecological-economic security of forest enterprises and substantiate the choice of indicators the authors clarified the main terms concerning the ecological and economic security and its components – financial, techno-technological, social security of forest use, reforestation, forest protection activities. The methodology for assessing the ecological-economic security of forest holdings was formed as a sequence of stages that ensure the formation of the information base of the study, substantiate the choice of indicators, allow for the processing and interpretation of the calculated results.

The developed methodology was tested on the data from four forest holdings. Adequate results have been obtained, which indicate a high and satisfactory level of ecological-economic security at these enterprises in 2017. Based on the comparison of individual indices the index method allowed, to identify the strengths and weaknesses of the enterprises and the factors that influenced them. The low financial security indicators were revealed, necessitating the adoption of appropriate management decisions to improve financial performance and financial position of enterprises, increase the efficiency of the available resources use, increase the enterprises' production potential. The main problem found is the inefficient export structure, namely the predominance of low value added products.

The studies carried out by the authors make it possible to conclude that the assessment of the company's ecological-economic security should be used as a preventive tool of permanent action, regardless of how successfully the company operates and at what stage of development it is.

## References:

- Artyushok, V. S. 2012. Kry`teriyi vidpovidnosti diyal`nosti lisogospodars`ky`x pidpry`yemstv strategichnij cili v umovax stalogo rozvy`tku [Criteria forestry enterprises of strategic objectives in terms of sustainable development], *Scientific Proceedings of the National University «Ostroh Academy»: Economy*, 19, 95-98. [http://nbuv.gov.ua/UJRN/Nznuoa\\_2012\\_19\\_22](http://nbuv.gov.ua/UJRN/Nznuoa_2012_19_22)
- Bilbao-Terol, A., Arenas-Parra, M., Alvarez-Otero, S., & Cañal-Fernández, V. (2019). Integrating corporate social responsibility and financial performance. *Management Decision*, 57(2), 324-348. <https://doi.org/10.1108/MD-03-2018-0290>
- Bogdanov, V., Ilysheva N., Baldesku E., Zakirov U. 2016. A model of the correlation between economic development and environmental performance based on the company's non-financial reporting data, *The Economy of the Region*, 12(1), 93-104. <https://doi.org/10.17059/2016-1-7>
- Cherchyk A. 2016. Ocinka ekologo-ekonomichnoyi bezpeky` pidpry`yemstv lisogospodars`koyi sfery [The assessment of ecological-economical security of the forestry enterprise], *Economic Innovation*, 61, 365-376.
- Cherchyk L. 2016. Konceptual`ni osnovy` formuvannya sy`stemy` socioekologoekonomichnoyi bezpeky [Conceptual basis for the formation system of Socioecological and economic security], *Economic Forum*, 2, 167-175. [http://nbuv.gov.ua/UJRN/ecfor\\_2016\\_2\\_27](http://nbuv.gov.ua/UJRN/ecfor_2016_2_27)
- Domashenko, M., Shkola V., Klimenko, O. 2014. Otsinka rivnia ekoloho-ekonomichnoi bezpeky zovnishnoekonomichnoi diialnosti pidpryemstva [Valuation of ecological and economic security of International Business], *Mechanism of Economic Regulation*, 1, 39-47. [http://nbuv.gov.ua/UJRN/Mre\\_2014\\_1\\_5](http://nbuv.gov.ua/UJRN/Mre_2014_1_5)
- Dovbnya, S., Gichova, N. 2008. Diagnosty`ka ekonomichnoyi bezpeky` pidpry`yemstva yak instrument vy`znachennya napryamkiv jogo innovacijnogo rozvy`tku [Enterprise economic safety diagnostics as a tool of its innovative development directions definition], *Economic Newsletter of the NMU. Series «Economics of Enterprises»*, 3 (23), 36-42
- Harrington, E.C. 1965. The Desirability Function. *Industrial Quality Control*, 21, April, 494-498.
- Hasanudin, A.I., Yuliansyah, Y., Said, J., Susilowati, Ch.; Muafi. 2019. Management control system, corporate social responsibility, and firm performance. *Entrepreneurship and Sustainability Issues*, 6(3), 1154-1168. [http://doi.org/10.9770/jesi.2019.6.3\(21\)](http://doi.org/10.9770/jesi.2019.6.3(21))

Hilkevics, S., Semakina, V. 2019. The classification and comparison of business ratios analysis methods. *Insights into Regional Development*, 1(1), 48-57. [http://doi.org/10.9770/IRD.2019.1.1\(4\)](http://doi.org/10.9770/IRD.2019.1.1(4))

Hromushyna, L. 2011. The nature and principles of ecologicaleconomic security of agricultural enterprises, *Economy. Management. Innovations*, No. 2. [http://nbuv.gov.ua/UJRN/eui\\_2011\\_2\\_53](http://nbuv.gov.ua/UJRN/eui_2011_2_53).

Ilysheva, N., Karanina, E., Elena Baldesku, Ulugbek Zakirov 2017. Detection of the Interdependence of Economic Development and Environmental Performance at the Industry Level, *Montenegrin Journal of Economics*, 13(4), 19-29. <http://doi.org/10.14254/1800-5845/2017.13-4.2>

Khvesik, M., Stepanenko, A., Obykhod, G. et al. 2014. *Ekologichna i pry`rodno-technogenna bezpeka Ukrainy` v regional`nomu vy`miri [Ecological and natural-technogenic security of Ukraine in the regional dimension]*, «Institute of Natural Resources Economics and Sustainable Development of NAS of Ukraine».

Kubaienko, A. 2018. Activation of the Economic Security of Ukraine in Terms of the European, *Montenegrin Journal of Economics*, 14(2), 91-114. <http://doi.org/10.14254/1800-5845/2018.14-2.6>

Kuklin, A. A., Kuklina, L. N., & Korobkov, I. V. 2018. Diagnostics of region's eco-economic security. *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM*, 18(5.3): 215-224. <https://doi.org/10.5593/sgem2018/5.3/S28.027>

Mikhaylov, A. S., Mikhaylova, A. A., Savchina, O. V. 2018. Innovation security of cross-border innovative milieu. *Entrepreneurship and Sustainability Issues*, 6(2), 754-766. [https://doi.org/10.9770/jesi.2018.6.2\(19\)](https://doi.org/10.9770/jesi.2018.6.2(19))

Kuril, J. 2018. Public administration for safe and secure environment: case of Slovak Republic. *Entrepreneurship and Sustainability Issues*, 5(3), 493-501. [https://doi.org/10.9770/jesi.2018.5.3\(6\)](https://doi.org/10.9770/jesi.2018.5.3(6))

Nikitina, M. G., Pobirchenko, V. V., Shutaieva, E. A., Karlova, A. I. 2018. The investment component in a nation's economic security: the case of the Russian Federation. *Entrepreneurship and Sustainability Issues*, 6(2), 958-967. [https://doi.org/10.9770/jesi.2018.6.2\(32\)](https://doi.org/10.9770/jesi.2018.6.2(32))

Narkunienė, J., Ulbinaitė, A. 2018. Comparative analysis of company performance evaluation methods. *Entrepreneurship and Sustainability Issues*, 6(1), 125-138. [http://doi.org/10.9770/jesi.2018.6.1\(10\)](http://doi.org/10.9770/jesi.2018.6.1(10))

Nikolenko, L., Jurakovskiy, E., Ivanyuta, N., Andronik, O., Sharkovska, S. 2018. Investment policy of governance of economic security of agrarian sector of Ukraine on the basis of Theory of Fuzzy Logics. *Montenegrin Journal of Economics*, 14(4), 125-140. <https://doi.org/10.14254/1800-5845/2018.14-4.9>

Prypota, V. 2013. Formuvannya informatsiinoi bazy za rezultatamy otsiniuvannya ekolohe-ekonomichnoi bezpeky promyslovoho pidpriemstva [Forming the information base for the evaluation of environmental and economic safety of industrial enterprises], *Biznesinform*, 10: 151-156. [http://nbuv.gov.ua/UJRN/binf\\_2013\\_10\\_29](http://nbuv.gov.ua/UJRN/binf_2013_10_29)

Tagiltseva, J. A., Drozdov, N. A. 2017. *Monitoring Socio-Ecological-Economic Security of Management Environmental Decisions* Young Researchers in Electrical and Electronic Engineering (EConRus), 2017 IEEE Conference of Russian, 2017, 1366-1370. <https://doi.org/10.1109/EConRus.2017.7910821>

Yevdokimova, M., Zamlynskyi, V., Kuznietsov, E., Sakovska, O., Anatolii, H. 2018. Evolution of social responsibility applied to the concept of sustainable development: mainstream of the 20th century. *Journal of Security and Sustainability Issues*, 8(1), 69-78. [https://doi.org/10.9770/jssi.2018.8.1\(6\)](https://doi.org/10.9770/jssi.2018.8.1(6))

Zemgulienė, J., Valukonis, M. 2018. Structured literature review on business process performance analysis and evaluation. *Entrepreneurship and Sustainability Issues*, 6(1), 226-252. [http://doi.org/10.9770/jesi.2018.6.1\(15\)](http://doi.org/10.9770/jesi.2018.6.1(15))

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## METHODOLOGICAL BASIS OF ECONOMIC DECISION-MAKING

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**Abstract.** The article aims to substantiate the methodological basis of economic decision-making as a science of choosing the most efficient ways of management carried out by corporate executives. Cooperation principles and methods in the system of collective entrepreneurship are closely connected to business success in corporate activities. The compliance with important corporate principles is conducive to the development of optimum managerial decisions. Managerial decisions provide a company's competitive advantages in the goods and services markets and normal operation of staff in these businesses. In the paper the author present original methodological approach towards decision making process.

**Keywords:** decision-making; utilitarianism; leadership; corporate management

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**JEL Classifications:** M1

### 1. Introduction

The article concerns the concept of economizing of decision-making. Structurally, it constitutes a combination of the following theoretical provisions (Vinogradova, Popov, 2014): 1) to formulate step-by-step actions (their motivation basis and systems of reference points); 2) to find out trends for efficient and innovative development of self-organizing entrepreneurial entities; 3) to treat what corporate leaders think about finding out and substantiating straightforward actions as a driving force for achieving business success.

As the authors understand, a corporation is a joint stock company, an independent subject of law that is established to carry out joint activities and attain specific goals. The key words are “corporate management”, “corporate culture” and “corporate organization”. They are united by the terms “decision-making” (the efficiency and quality of decisions) and “economization”, which means that a corporate body musters and further develops institutional experience and an economic mentality (Vinogradov, Popova, Popov, 2017).

From the angle of economization, every corporate manager should be a businessperson. The article is, therefore, especially focused on entrepreneurial, innovative and culture-building management. “The very same spirit of entrepreneurship that can create new private enterprises is required in corporate management, and not only at the initial stage,” writes F.J. Rogers. “No matter how big or old a corporation is; if it intends to adequately react to changes and grow all the time, it should preserve this initial spirit that transforms someone’s ideas and dreams into real business” (Rogers, 1997).

Corporate management is not only about the sale of goods produced, but also the development of the new ones (of the better quality). It is this factor that constitutes a decisive resource, providing any entrepreneurial enterprise with prosperity on the market. “That’s why this area of business is also exclusive competence of senior management,” W. Heuer (1992) writes. The above concerns corporate culture that plays an important role in making efficient managerial decisions of both strategic and tactical nature. The issues related to approaches towards managerial decision making processes are under ongoing scientific discussion (Plenkina et al. 2018; Labanauskis et al. 2018; Tvaronavičienė 2018; Tvaronavičienė et al. 2018; Colapinto et al. 2020).

As a whole, the article lays special emphasis on the development of a managerial decision (MD) as a scientific problem. As practice shows, in the course of time – once economic situations and managerial tasks become more complicated – this problem becomes more urgent, especially in the direction of revealing the methodological basis of economic decision-making.

## **2. Methods**

Empiric, organizational, psychodiagnostic, with the use of SWOT and COPS analysis of corporate activities.

## **3. Results and discussion**

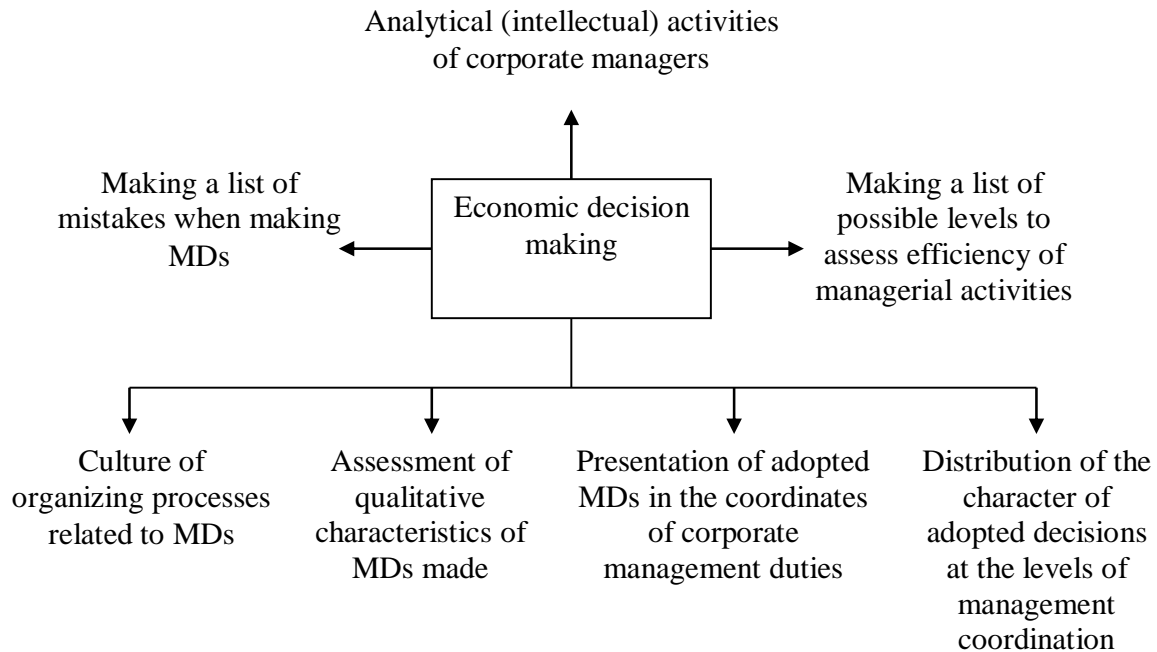
Problems related to the development of an MD, as the main tool of managerial impact, arose in the mid-1960s, owing to the efforts taken by American scientists J. Marn, R. Sauert, G. Simon, etc. This new area, being at the junction of the theory of organization, modeling, the economics of sociology and psychology, was named managerial economics (Remennikov, 2000).

Later this problem was studied by representatives of other scientific approaches to the development of management (process, system and situational).

Issues related to the assessment of efficiency and quality of decision-making and the development of plans of actions in the conditions of uncertainty and risks have become more important over the past few decades. Moreover, nowadays it is impossible not to take into account the economic mentality of decision makers (DMs) and the role of entrepreneurial companies (corporations) in the process. Entrepreneurial companies have been paying much closer attention to economic decision-making from the angle of corporate activities. This concerns complicated decisions made in the conditions of flexible management of entrepreneurial activities and the psychological aspect of MD development. However, of special importance is the systemic understanding of economic decision-making as a science of choosing the most efficient ways of managerial activities for corporate managers (Figure 1).



**Fig.1.** Systematic presentation of economic decision-making as a science of choosing the most efficient methods for managerial activities of corporate managers



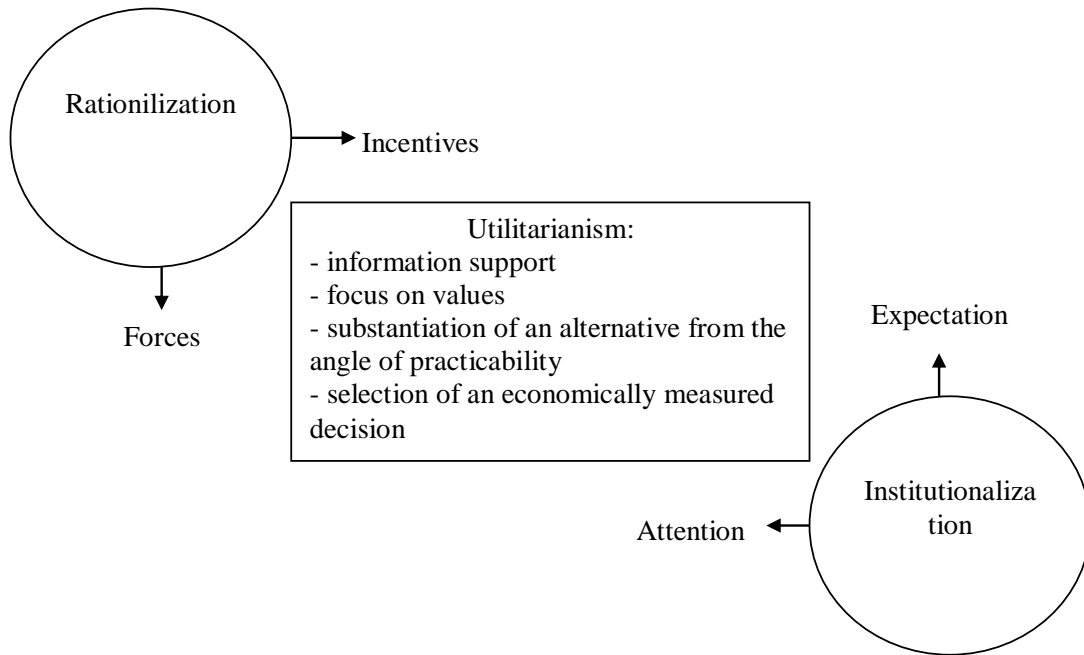
*Source:* developed by authors

Among the methodological bases of economic decision-making, the authors also mention the model-based presentation of economic decision-making (Figure 2). The following parameters are meant:

- 1) Rationalization (incentives to make decisions and powers of impact and action);
- 2) Utilitarianism (to maximize practicability on the basis of effective – corporate – activities);
- 3) Institutionalization (expectation and attention to consequences of decisions to be made).

Here it is important to focus on the creation of values, organizational culture-building, network management, responsibility and delegation of authority (given trustworthy relations) in the course of operations to achieve business success.

**Fig.2.** Model-based presentation of economic decision-making



*Source:* developed by authors

The efficiency of making MDs is one of the most important conditions for the successful development of a corporate organization, its survival in a competitive struggle and successful adaptation to changes in external conditions. At issue is organizational, social, technological, psychological, legal and economic efficiency (the ratio between the cost of an additional product as a result of a specific MD and selling costs). This type of efficiency can be determined if the goal of MD is set in some quantitative indicators relating to the activities carried out by a corporate organization as a whole (or on a specific market or at a certain production stage). Resources, which ensure the efficiency of MD, usually include professionalism of leaders (top managers), their cognitive and organizational talents, as well as finance and incentives in the system under consideration.

In order to be efficient, i.e. to attain some goals set, a decision should meet some requirements. Above all, it should be realistic and include mechanisms of implementation (Dawson, 1996).

MDs are not only a process, but also a condition and result (Table 1).

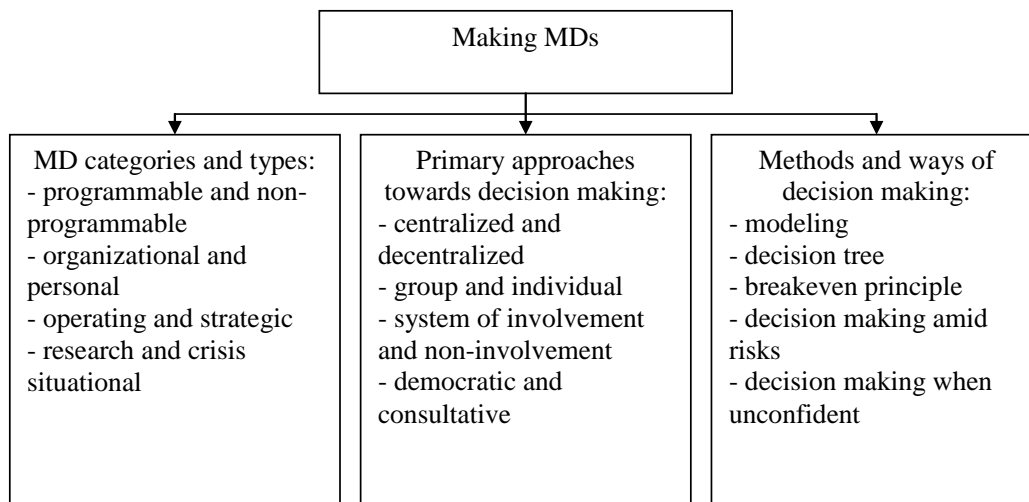
**Table 1.** MD as an integrated concept

MD	Underlying factor
1. Process	Organizational process, mentality of the organization's leader, its corporate management
2. Condition	Corporate culture as a technological and moral basis for decision-making
3. Result	Efficiency of corporate activities (the MD quality and costs as mental activities and changes in the corporate culture)

*Source:* developed by authors

Decision-making is a “product” manufactured by the leader in the course of management. For this reason, the knowledge of technologies and methods of elaborating MD are an essential element of professional qualification of a corporate leader.

Figure 3 shows the essence of the systematic presentation of MDs adopted in the system of corporate management. The data below can help understand how MDs are taken.



**Fig.1.** Making MD in the coordinates of corporate management

*Source:* developed by authors

Extensive literature devoted to corporate management shows that the concepts of decision-making and managerial activities are so much interconnected that they are often used as synonyms (Golubkov, 2003). This comes from the following functions of corporate management: strategic planning, innovative management, and organizational culture-building. This is also an analytical (cognitive) activity as a function of the corporation's leader (director) and its agent center.

Executives should analyze, firstly, the business position in the market, secondly, production of goods and services while changing sales activities and, thirdly, delegation of authority in the corporate management system from the viewpoint of market relations as trustworthy. In other words, the creation of the business climate in this system plays a decisive role in promoting successful activities and making efficient decisions on the production and sales

of goods and services to be manufactured. Not accidentally, specialists pay attention to the following mistakes made by corporate managers:

- checking results instead of impacting a corporate decision;
- not caring about the achievement of business success as important in principle;
- directing all employees in the same manner (they are all different; it is not possible to achieve success without understanding this);
- focusing not on goals, but problems (and on the adoption, in this connection, of efficient MDs).

All of this relates to the methodological basis of economic decision-making of a person authorized to do so as part of corporate management.

It is objectively necessary for such a person to seek a certain external force that should set the order, impose rules of the game, which create a structure of interaction within the corporate management system, and eventually to reduce the degree of uncertainty in interrelations within this system.

This force is institutions (rules and standards) that act as a barrier and prescription of actions capable of forming expectations about achievements when bringing MDs to reality. As such, the authors classify norms of trust and organized culture (and, to a large extent, institutional norms and rules of business ethics, rights of ownership, economic freedom and legislation).

D. North wrote about this the following: “players’ mental constructions set by the complexity of the surrounding world, limited information feedback with the results of activities inherited by cultural traditions determine their perception” (North, 1993).

Moreover: “The entrepreneur will assess benefits from entering into new agreements as part of the current institutional structure”. As for the latter, at issue are changes in the formal rules that can be the result of legal and constitutional changes that determine the rules (meta-rules), on which the entire system of rules is built.

As M. Mescon and his co-authors fairly said, the core of management is “to impact the organization and change its structure for the purpose of making optimal decisions” (Mescon, Albert, Khedouri, 2004). The authors understand optimal decisions as one of the specific – primary – functions of management (the key factor when performing all other managerial duties). In this regard, speaking about economic decision-making is justified (Popov, Vinogradova, 2017).

## **Conclusions**

1. The research is based on the methodology of economizing the MD development. In accordance with which, the MD development:

- 1) Changes a corporation’s external condition (financial, socio-economic, scientific-technical);
- 2) Takes into account time spent and costs incurred to prepare, accept and implement an MD;

3) Touches upon private and local performance parameters of the entire system of managing corporate activities. When doing so, MD results can produce both positive and negative effect.

2. A number of factors determine the efficiency of an MD. They are the availability of conceptual basis for its development, the application of substantiated methods and models, manageability of an object under management (above all, personnel). Other factors are competency, the level of responsibility and experience of a person who makes an MD, and the level of collegial decision-making.

Necessary terms for right MDs in the area of corporate activities should be determined in the course of research. First and foremost, it is necessary to define a list of mistakes made when making MDs and possible grades for the efficiency of managerial activities. Especially it is important when at issue are non-standard, creative decisions that are inevitable when competition toughens in the goods and services market. These terms relate to the following: 1) constant efforts taken by persons who make MDs to increase qualification; 2) the right way of setting goals (at the personal level of corporate management) and the ability to achieve them; 3) training of independence as a part of self-management; 4) reasonableness of thinking especially when managers have to make urgent MDs that substantially determine business success of the entire corporation.

3. The MD general scheme includes the following elements: goal, means, time, probability (if means and time are available) of resolving a problem (eliminating it), the development of a decision (given analysis of managerial alternatives), control over execution (as an important element of successful management of corporate activities), assessment of a virtually executed MD and the exploration of new possibilities and arising situations. When making an MD, it is also important to answer the question about accounting (what, why, when and how much all these costs, especially when information and the degree of reliability are concerned).

4. One of the methods applied in practice in most cases to assess the efficiency of MDs is the one of profit and cost. Meanwhile, profit is understood as a certain aggregate of criteria that characterize a specific decision. They are both objective and subjective estimates, i.e. payment flows, breakeven period, profitability, and image (Hilkevics, Semakina, 2019)

5. To this way of the conclusion, the authors dedicate the topic of conducting advanced training courses for executives named “Economic decision-making”. The topics covered are as follows:

- Specific features of decision-making at a corporate organization (The concept of corporate organization. Management of a corporation. Analysis of the full cycle of managerial activities. Preparation, adoption and execution of a managerial decision. Decision maker. The process of decision-making. The object of a managerial decision, its optimality);
- Optimal mechanisms of making MDs (Theoretical and methodological approaches towards the development of optimal mechanisms to make MDs. Project management. The role and the place of anti-crisis management in the system of corporate management. Requirements of the complex approach to management of corporate activities in the conditions of uncertainty and risks. Corporate culture as a mechanism for making optimal decisions);
- Information support of the process of making an optimal decision (Assessment of required information, its classification. The formation of a research database for the preparation and the adoption of an optimal decision. Catalogues (guides) of analytical information. The place of management accounting in the information system);

- Decision-making in structured situations (Methods of solving multi-criteria tasks. The search for an optimal decision. The analytical solution of the task related to linear optimization (the simplex method). The automated solution of the task related to linear optimization (Excel). Methods of solving JA tasks. The principle of the maximax and minimax regret. The selection procedure in structured tasks).

## References

- Colapinto, C.; Jayaraman, R.; & La Torre, D. 2020. *Goal programming models for managerial strategic decision making*, Studies in Systems, Decision and Control, 177, 487-507 [https://doi.org/10.1007/978-3-319-99918-0\\_16](https://doi.org/10.1007/978-3-319-99918-0_16)
- Dawson, R. 1996. *The Confident Decision Maker: How to Make the Right Business and Personal Decisions*. Translated from English. Moscow: UNITY, 255.
- Golubkov, V. N. 2003. Managerial decisions. *Management in Russia and Abroad*, 1.
- Heuer, W. 1992. *How to do business in Europe*. Moscow: Progress, 253.
- Hilkevics, S.; Semakina, V. 2019. The classification and comparison of business ratios analysis methods, *Insights into Regional Development* 1(1): 48-57. [https://doi.org/10.9770/ird.2019.1.1\(4\)](https://doi.org/10.9770/ird.2019.1.1(4))
- Labanauskis, R.; Kasparavičiūtė, A.; Davidavičienė, V.; Deltuvienė D. 2018. Towards quality assurance of the study process using the multi-criteria decision-making method, *Entrepreneurship and Sustainability Issues* 6(2): 799-819. [http://doi.org/10.9770/jesi.2018.6.2\(22\)](http://doi.org/10.9770/jesi.2018.6.2(22))
- Mescon, M.; Albert, M.; Khedouri, F. 2004. *Basis of Management*. Translated from English. Moscow: Delo, 799.
- North, D. C. 1993. *Institutions, Ideology and Efficiency of the Economy*. From planning to market: the future of post-socialistic republics. Moscow, 307.
- Plenkina V.; Andronova I.; Deberdieva E.; Lenkova O.; Osinovskaya, I. 2018. Specifics of strategic managerial decisions-making in Russian oil companies, *Entrepreneurship and Sustainability Issues* 5(4): 858-874. [http://doi.org/10.9770/jesi.2018.5.4\(11\)](http://doi.org/10.9770/jesi.2018.5.4(11))
- Popov, A. N.; Vinogradova, N. P. 2017. *Economic decision-making*. Moscow: Russian Academy of Natural History, 210.
- Remennikov, V. V. 2000. *Development of a Managerial Decision*. Moscow: UNITY-DANA, 140.
- Rogers, F. J. 1997. *The Success Path. How IBM Works*. Saint Petersburg: Azbuka-berra, 256.
- Tvaronavičienė, M. 2018. Leadership fostering via teaching business case studies: opportunities and limitation. Proceedings of the 2nd International Conference on Social, Economic and Academic Leadership (ICSEAL 2018) [Advances in Social Science, Education and Humanities Research](https://doi.org/10.1007/978-3-319-74216-8_59) ISSN 2352-5398 ISBN 978-94-6252-592-4 Publication date 2018/10/30 [doi:10.2991/icseal-18.2018.38](https://doi.org/10.2991/icseal-18.2018.38), Atlantis Press, p.272-276
- Tvaronavičienė, M.; Mentel G.; Chyrva, H. 2018. Leadership in energy security: behavioral patterns and long-term energy intensity. In: Strielkowski W., Chigisheva O. (eds) *Leadership for the Future Sustainable Development of Business and Education*. Springer Proceedings in Business and Economics. Springer, Cham [https://doi.org/10.1007/978-3-319-74216-8\\_59](https://doi.org/10.1007/978-3-319-74216-8_59) [https://link.springer.com/chapter/10.1007%2F978-3-319-74216-8\\_59#citeas](https://link.springer.com/chapter/10.1007%2F978-3-319-74216-8_59#citeas)
- Vinogradov, N. P.; Popova, A. A.; Popov, A. N. 2017. *Economics of Business Success*. Moscow: Russian Academy of Natural History, 210.
- Vinogradova, N. P.; Popov, A. N. 2014. *Management Economics. Institutional System. Tools to make managerial decisions*. Kostanai: Kostanai branch of the Chelyabinsk State University, 2000.



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## INTEGRATED QUALITY MANAGEMENT SYSTEM FOR FOOD PRODUCTION: A CASE OF DAIRY PRODUCTS' ENTERPRISE

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**Abstract.** The article presents results of the researches on creation of integrated quality management system for food enterprise reflecting branch specifics in a basis of the international ISO standards of series 9000 and the principles of HACCP. Theoretical and practical aspects of construction and development of systems of QMS and HACCP are analysed and the technique of creation of the integrated quality management system (IQMS) of the Raimbek Agro Company is offered. Degrees of compatibility of the international ISO 9001:2015 standard (ST RK ISO 9001-2016) and the principles of HACCP (ST RK 1179-2003) are defined. The conceptual model of the IQMS is offered. Areas of integration of HACCP and QMS systems are also established and the additive model of creation of the IQMS is chosen. The network of the processes of the IQMS of the Raimbek Agro Company on the basis of the carried-out processes integration is created.

**Keywords:** QMS (quality management system); process approach; HACCP (Hazard Analysis and Critical Control Point); IQMS (Integrated Quality Management System); dairy products.

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**JEL Classifications:** Q01, Q14

**Additional disciplines:** food technology, ecology

## **1 Introduction**

In present time the modern enterprises of various industries are forced to function in conditions of high complexity and dynamism of social and economic environment. In modern market conditions, the stable and successful activity of an enterprise is defined by a number of factors, the basic of which is the ability to satisfy the needs of the consumer with high-quality and safe products. It is possible to be kept in the market only at existence of real high-organized competitive advantages and for this purpose it is needed to have the perfect organization of work of the enterprise.

A variety of management systems and the standards are used during their creation, constantly growing and covering various fields of the company activity. Thus, now management systems represent the effective tool by means of which organizations can optimally build their activity according to the modern requirements constantly amplifying in the conditions of competition. In documents, establishing requirements to the management systems, is generalized international experience of system management of quality, ecology, personnel, labor protection and industrial safety, information support of systems, etc.

Quality management system is that part of the general management system at the company which functions with the purpose of ensuring stable quality of products or services. Quality management systems occupy the special place among all existing management systems, since they are one of the latest achievements in the area of the quality problems solution at any organization (Conti, T., 2005; Maximov and Papkov, 2003; Alymbekov K.A., 2003; Chris Bamber, John Sharp, Mick Hides, 2002).

As it was noted in the article of the main author (Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017), the development of integrated management systems considering the specific features of the enterprises when focusing on concrete branches of the industry, in particular its modification in food industry is of special interest.

For integration of quality management it is important to provide an effective management of the processes operating at the enterprise. It is caused by the fact that the quality directly depends on efficiency of these processes and operations making them, on the organization of information streams between processes and operations in the course of creation of products. Therefore, the quality in the mode of real time is defined by control of processes, the applied techniques and work of personnel (Watkins David K., 2006).

"Integration" is a process of mutual adaptation, expansion of economic and production cooperation. "Under the integrated management system, (M.Z. Svitkin) should be understood as part of the general management of the organization meets two or more international standards for management systems and functioning as uniform whole" (Svitkin M.Z., 2004).

In a real situation there is always a set of the factors capable to render influence on integration of management systems of the organization. It is possible to identify as such the factors following:

- 1 Harmonization of the purposes and objectives; at statement of the purposes and objectives it is necessary to consider expediency of the accepted decision, i.e. to correlate expenses to estimated profit;
- 2 The distribution of priorities in the organization affecting degree and depth of systems integration;
- 3 Existence of management system which is already operating at the enterprise;

4 Requirements and expectations of stakeholders;

5 The structure of systems: for example, the uniformity of management systems (identity of structural elements and proximity of nature of their interrelation) promotes integration;

6 Requirements of improvement of efficiency and effectiveness of management can act as the factor promoting integration of systems;

7 Stability of organizational structure of the enterprise (Chris Bamber, John Sharp, Mick Hides, 2002; Tvaronavičienė M., Tarkhanova E., Durglishvili N., 2018).

The principle of systemacity is one of the main principles on which quality management is based. Management of the interconnected processes as a system improves effectiveness and efficiency of activity of organizations at achievement of purposes (Rodionova Yu.A., 2013).

## **2 Assessment of functioning of quality management system for food enterprise and development of the strategic solutions for development of management system (Literature Review)**

A subject of this research are theoretical and practical aspects of management of enterprise activity introducing integrated quality management system on a basis of modern methods of quality management with use of the system analysis, process approach, a method of expert estimates, analysis of the production practice which developed at the enterprise. An object of a research is the functioning quality management system of Kazakhstan enterprise for production of dairy products Raimbek Agro Company (Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017).

The ISO standards of series 9000 are a universal basis for creation of quality management system in any organization, independent of the area of activity, applied technologies, qualification and number of employees, and also of other features (Lafta J.K., 2007; Edda Saunders, Ray Saunders, 2005).

But, the universality of standards has also the hidden side. It does not allow to consider the features of a number of the branches of industry where requirements for quality, safety, environmental friendliness are high, therefore, in this situation application of requirements of ISO standards of series 9000 is insufficient. In this regard standards gained branch specifics and on their basis the systems of standards for application in the concrete industries were developed. Use of these standards allows to create the effective system of quality management at concrete industrial sector (Shalayev A.P., 2006; Avstriyevsky A.N., Kantare V.M., Surkov I.V., 2007). In the table 1 the standards applied at food industry are presented (Akhmetova, S.O., Omarova, A.A., 2014).

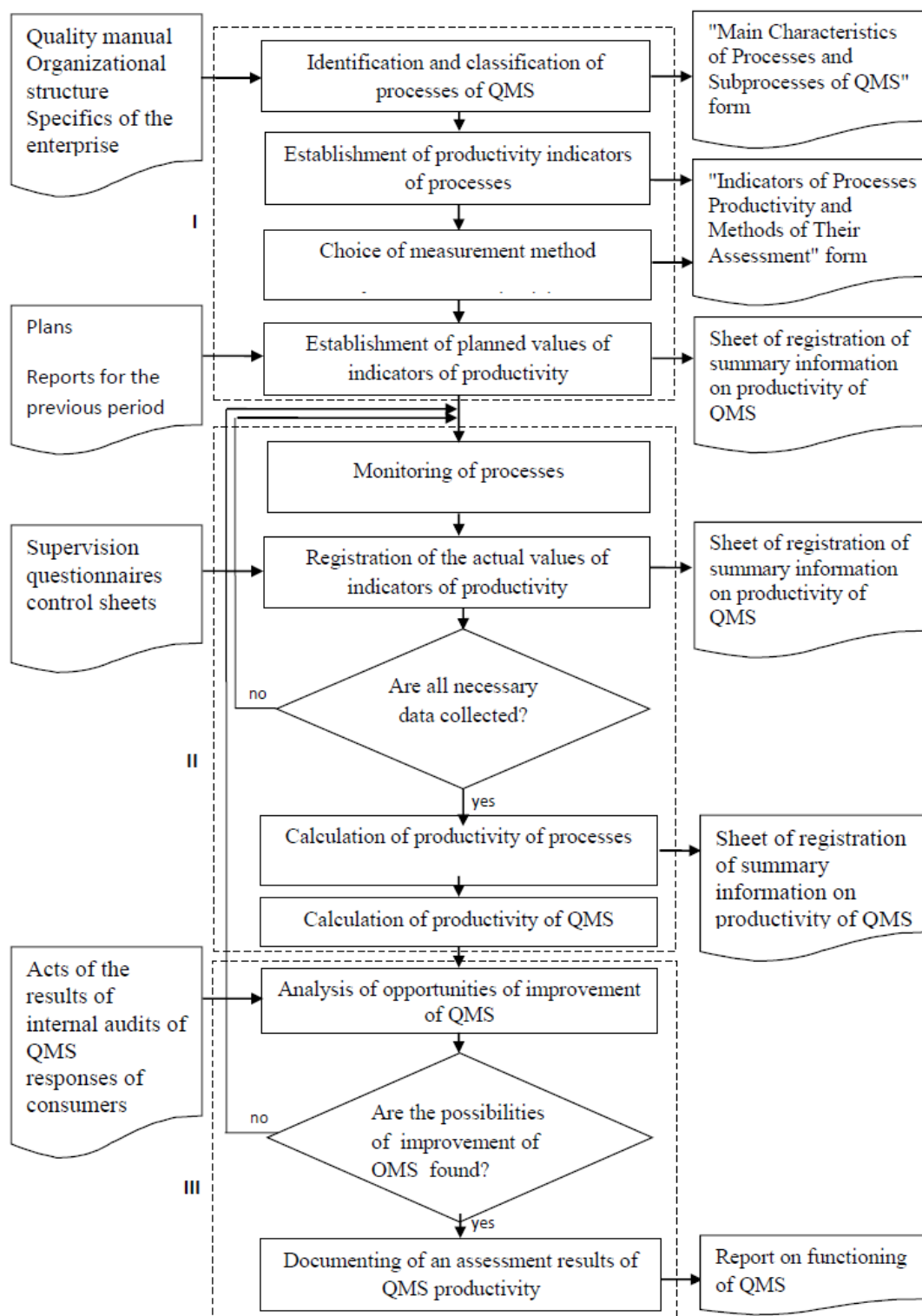
**Table 1.** The Branch (food industry) Quality Management System on a base of ISO International Standards of series 9000.

1	2	3	4	5
Quality Management System for Food Industry	International ISO 22000:2018 Standard «Food safety management systems - Requirements for any organization in the food chain»	Ensuring accounting of consumers expectations concerning safety of food products, when developing management system in compliance with requirements of ST RK ISO 9001:2016 (ISO 9001:2015) standard [36]	ISO 22000:2018 standard dynamically unites the principles and practice of HACCP with programs of preliminary conditions, using the analysis of risks for definition of the strategy providing risk management and coordination of programs of preliminary conditions with the plan of HACCP [69].	Complex application of two standards will become for manufacturers an effective instrument for production safe food products, meeting requirements of the legislation, consumers and manufacturers [69].

Realization of the process approach at the enterprise for production of dairy products "Raimbek Agro" LLP has made it possible to strengthen the relations between divisions of the enterprise and to create a basis for the analysis of processes (Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017). In the present time each process participant can obtain full information on all processes and their interrelations in their workplace.

In this case, he or she has an opportunity to do offers on improvements of process which participant he or she is. On a basis of such experience the highest management received an opportunity more deeply to estimate the cost-effectiveness for time and resources. The executed work helped to create the required base for definition of priorities of improvement of the enterprise activity. In the new conditions the routine and perspective planning is provided and the enterprise works as a sophisticated mechanism.

The systematic analysis of quality management system from the management, an assessment of its productivity, suitability and opportunity for improvement is one of requirements of the ISO 9001-2015 standard by means of which the principle of quality management - decision-making based on facts - is enabled to realize (ST RK ISO 9001-2016). For the purpose of providing this requirement and realisation of the specified principle the technique of the assessment of productivity of quality management system was developed. The operative procedure for the assessment of productivity of QMS according to the developed technique is reported in fig. 1.



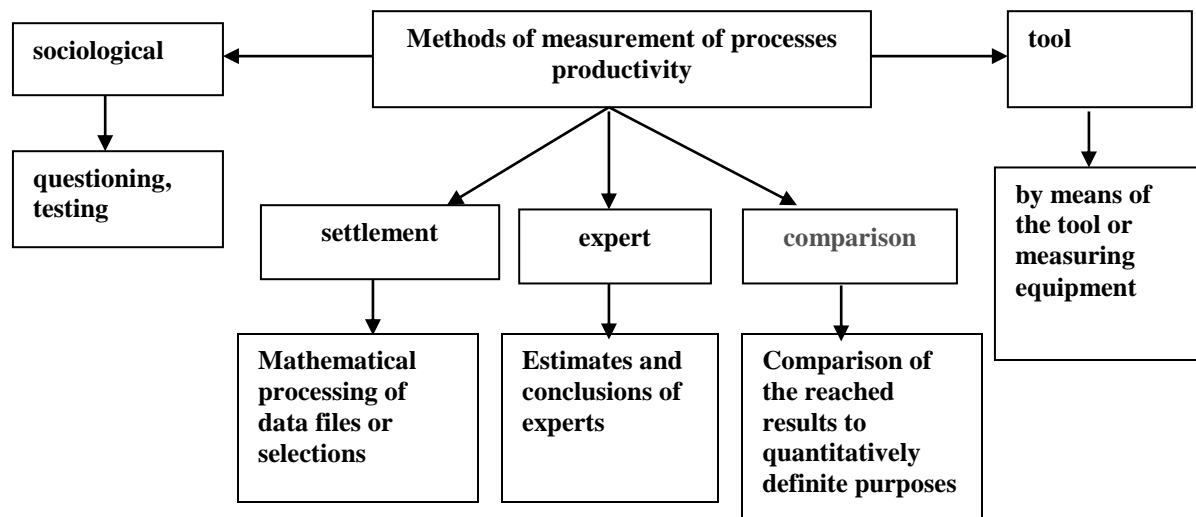
**Figure 1.** Algorithm of a Technique of Assessment of Productivity and Continuous Improvement of QMS

Source: composed by the authors



In light of the process approach the QMS represents itself as a network of the interconnected processes, therefore the assessment of its productivity is reduced to the assessment of the productivity of the processes and an initial stage of the assessment is the identification and classification of the processes depending on their role in the QMS.

Measurement processes in QMS are the most difficult tasks in practical application. Depending on the processes features different methods of measurement can be used: sociological, expert, comparisons, settlement and tool (fig. 2).



**Figure 2.** Methods of measurement of processes productivity

*Source:* composed by the authors

As a result of the carried-out work indicators of productivity and methods of their measurement were established (Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017). A technique for the assessment of productivity and continuous improvement of QMS, on the basis of which the analysis of functioning of Raimbek Agro Company QMS, has been developed and implemented. The technique allowed establishing a cause and effect relationships between the planned and reached results. Updating of the document "Process model of Raimbek Agro LLP" has become a final result of this work.

Regular estimation of a condition of the enterprise processes functioning, the fullest accounting of the factors affecting results of processes the continuous analysis of planned values of processes results promote increase in effectiveness of QMS and the organization in a whole.

Assessment of productivity of QMS, the analysis of performance of the warning and adjusting actions planned by the results of its functioning and further planning of improvement of the QMS provide continuous improvement of the enterprise activity. Thus, the possibility of acceptance of operational measures for achievement of the planned results and to correct the purposes already at intermediate stages of planning by adopting the principle of achieving the most possible result but not of real approachability is provided.

Assessment of functioning of the enterprise management system is an initial stage of formation of development strategy of the enterprise management system. In the present time assessment of functioning of "Raimbek Agro"

LLP management system is based on assessment of QMS productivity which includes collecting and analysis of information of processes functioning. The final stage is development of development strategy of management system of the enterprise which considers the circumstances reflecting changes in the external environment and degree of adequacy to this medium of the enterprise profile, and also the results connected to a new vision of the enterprise.

Thus, the formation of the development strategy of management system based on assessment of its functioning and the comprehensive analysis of the obtained data promotes improvement of diagnostic culture of the enterprise, gradually developing abilities of people to understand communications between system factors, processes and results, involving them in active participation in the choice and realization of strategy. The strategy developed with accounting of requirements of the interested parties is directed to maintenance of such relationship of the enterprise with the external environment which allows it to reach the purposes, correspond to internal opportunities and do it susceptible to external requirements.

On the basis of the comprehensive analysis of the obtained data and the assessment of QMS functioning, an enterprise development strategy focused on the satisfaction of the requirements of all interested parties was developed. One of the key directions of the enterprise development strategy is determined the integration of HACCP system into the operating QMS (Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017).

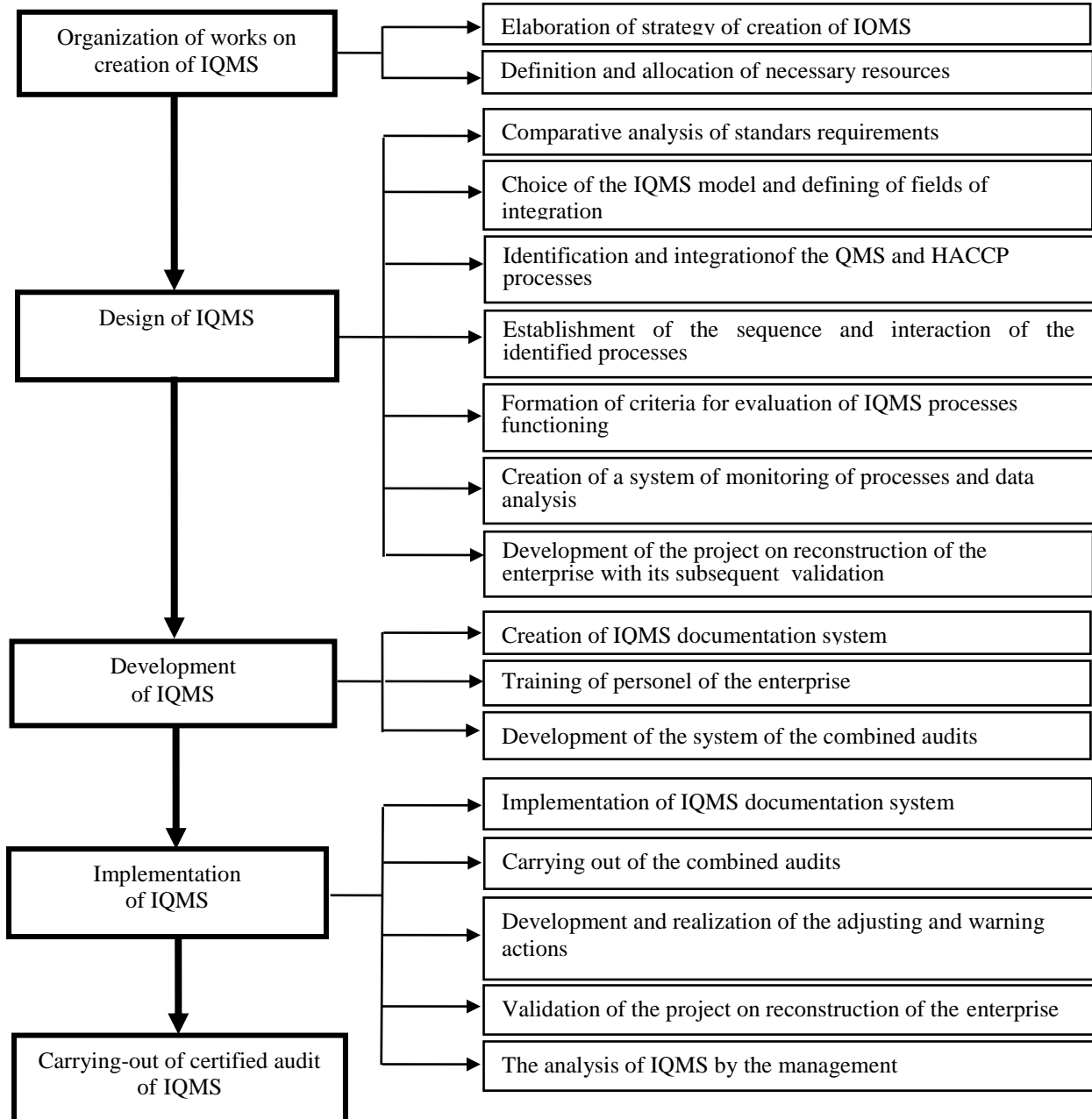
### **3 A technique of creation of integrated quality management system for food enterprise: results and discussions**

#### **3.1 Development of a project of creation of integrated quality management system for "Raimbek Agro" LLP**

Creation of the IQMS is the complex innovative project directed to increase in efficiency of general management of an organization. Organizationally and methodically development and implementation of a draft of IQMS creation promotes increase in level organizational-technological maturity of processes and the enterprise in a whole and provides introduction of HACCP (Alymbekov [K.A.](#), 2003; Yefimov V.V., 2009) system considering branch specifics.

Initially we analysed theoretical and practical aspects of stages of construction and development of QMS and HACCP systems on a basis of studying of scientific-theoretical publications in the area of quality, and also practical experience of introduction and development of these systems.

The analysis of stages of development and introduction of QMS and HACCP showed existence during creation of these systems of the main similar procedures, such as: inspection of the enterprise for the purpose of detection of its readiness for creation of the considered systems; development of documentation structure and introduction of the documentation of these systems; personnel training; carrying out the self-inspection and certified audit. Therefore the approach and stages of works on integration of HACCP system at existence of quality management system are similar to approach during creation of quality management system with accounting of the established distinctions. At building of an algorithm of creation of IQMS we developed a complex of the stages considering specifics of development and introduction of two considered systems. IQMS construction order includes consecutive performance of the following stages: organization of IQMS development, IQMS design, IQMS documenting, implementation of IQMS, preparation IQMS for certification (fig. 3).



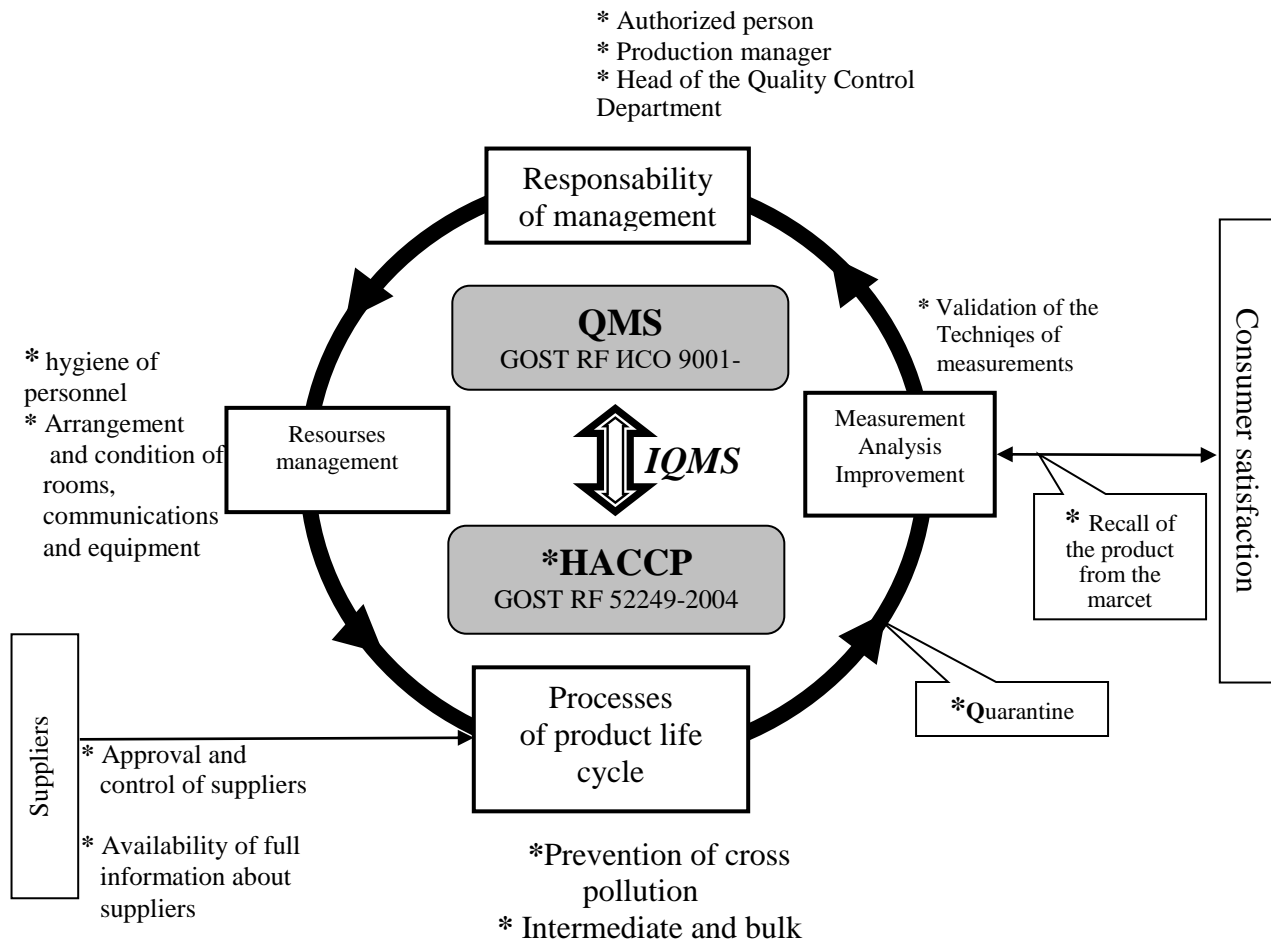
**Figure 3.** Algorithm of a technique of creation of IQMS

*Source:* composed by the authors

### 3.2 Formation of a conceptual model of the management system integrating requirements of the international ISO standards of series 9000 and HACCP principles

Initial stage of IQMS design is the comparative analysis of requirements of the introduced standards, for this purpose for assessment of the possibility of integration of the HACCP system in the operating QMS at the "Raimbek Agro" LLP enterprise we considered structures of the ST RK ISO 9001-2016 and ST RK 1179-2003 standards.

ST RK 1179-2003 submit themselves the system of requirements, recommendations and measures which performance is intended to help the enterprise to organize release of quality products. In distinction from the ISO standards of series 9000, it has concrete branch orientation and is strongly detailed.



**Figure 4.** The conceptual Model of a Management System Integrating Requirements of QMS and HACCP

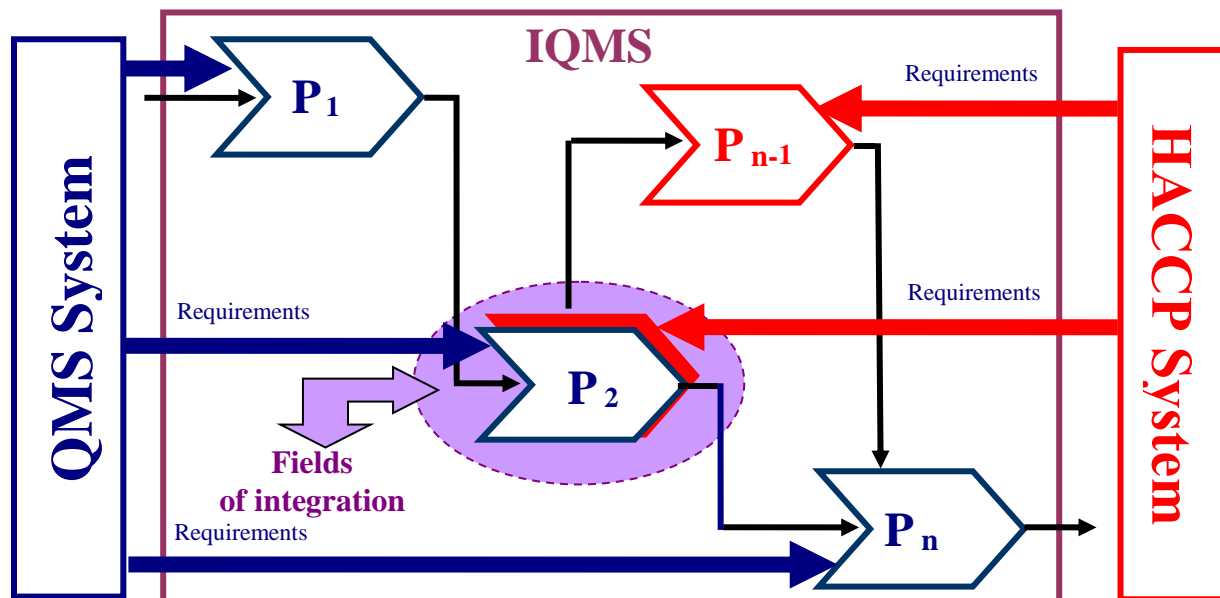
Source: composed by the authors

The methodological and ideological proximity is characteristic of the ST RK ISO 9001-2016 and ST RK 1179-2003 standards. Thus, association of these management systems in IQMS is promoted by proximity of composition and structure of objects of standardization, compatibility of a number of elements and requirements. The universality of methodology and requirements of the ISO 9001 standard allows integrating without special difficulties into the management system of enterprise, the ST RK 1179-2003 standard.

Creation of IQMS assumes formation of the uniform model based on the basic approaches and the principles underlain in the international standards for management within different systems by organic combination of their requirements (Zamyatina O.V., 2006; Ungan Mustafa C., 2006; Yefimov V.V., 2009). Taking into account the formulated requirements the conceptual model of a management system integrating requirements of QMS and HACCP (fig. 4) was created.

The created conceptual model reflects requirements imposed by the international ISO standards of series 9000 and the HACCP rules for quality and safety of food products and allows to minimize the all types of resource-production (human, temporary, material, etc.) used during the developing, implementation, certification of IQMS and its further functioning

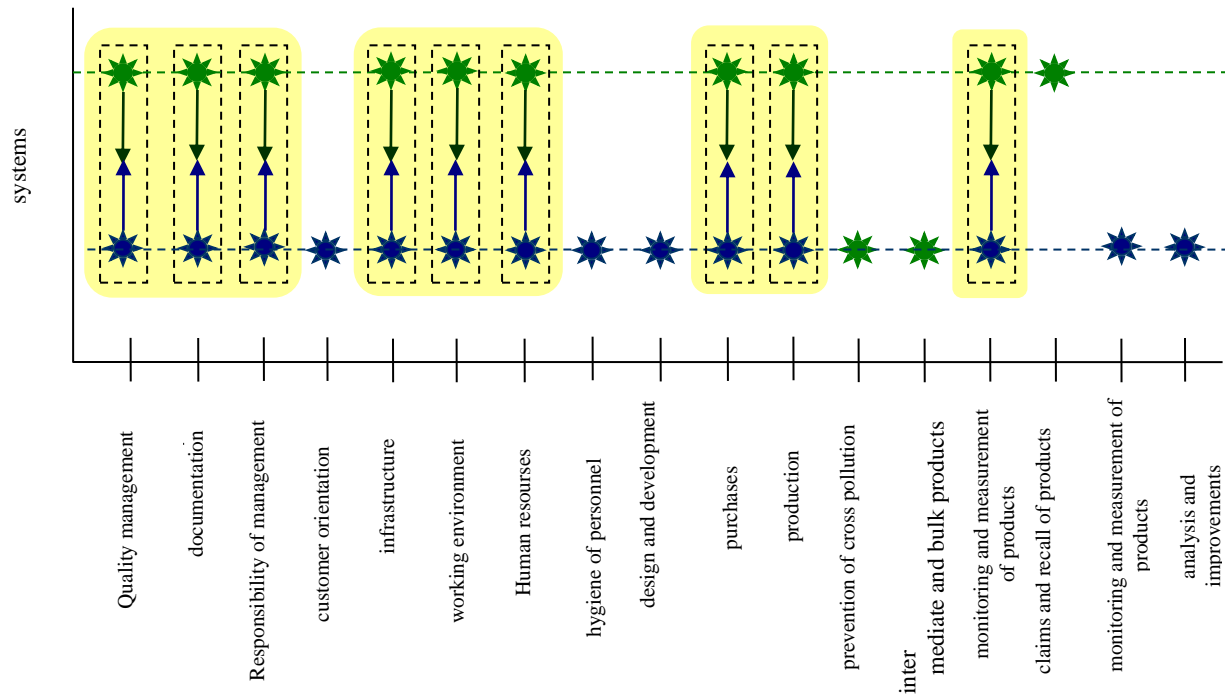
The choice of a way of creation of IQMS is carried out depending on existence or lack of the functioning management system at the enterprise, features of management systems and their orientation on accounting of requirements of the external environment. Considering the sphere of activity, the size of the enterprise, specific legislative requirements and the available experience in management of the enterprise, we offered the mechanism of creation of the IQMS additive model for the food enterprise "Raimbek Agro" LLP created on a basis of already existing and productively functioning QMS (fig. 5).



**Figure 5.** The mechanism of creation of the IQMS additive model

*Source:* composed by the authors

For realization of the mechanism of creation of additive model it is necessary to define accurately the fields of integration representing by themselves a set of requirements of the considered standards which are characterized by the greatest ideological proximity. With use of the principle of combination of elements the fields of integration are established (fig. 6).



**Figure 6.** The fields of integration of the QMS and HACCP systems

*Source:* composed by the authors

As a result 9 fields of integration were defined: quality management, documentation, responsibility of the management, infrastructure, production environment, human resources, purchases, production, monitoring and measurement.

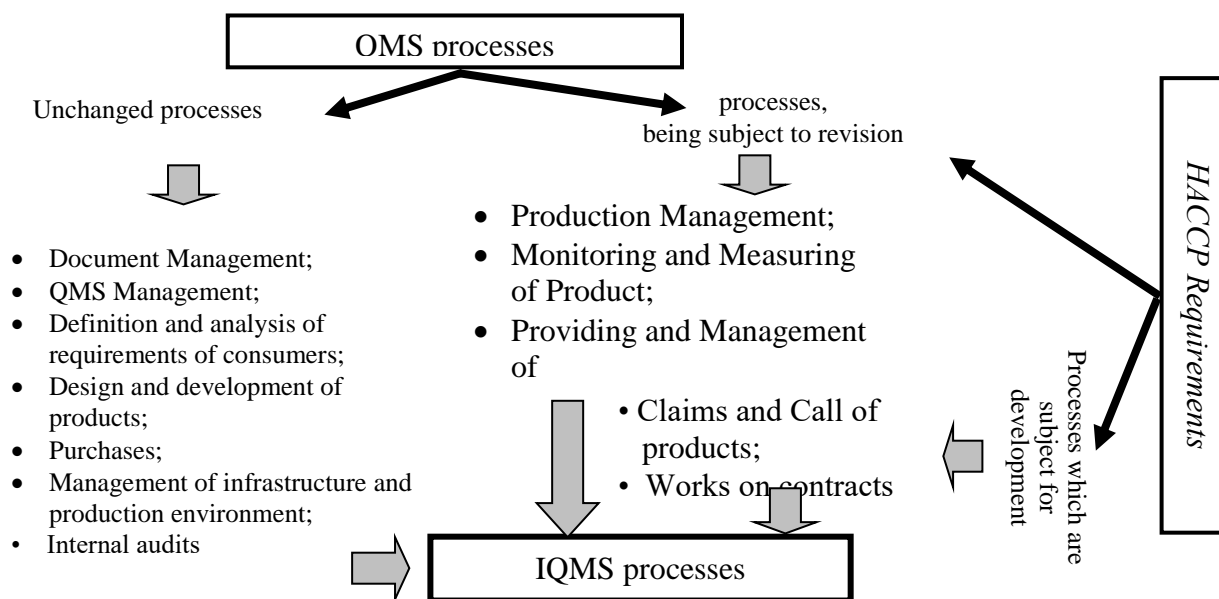
### 3.3 Decomposition of processes and formation of network of the processes meeting requirements of IQMS

One of the main problems of design of the integrated management system is the stage of identification and integration of the QMS and HACCP processes, with the subsequent establishment of the sequence and interactions of the identified processes. At decomposition of processes and integration them into the general network of processes of the enterprise is very important to provide an effective use of all types of resources and integrity of perception of the management system by the management and personnel,



an also to exclude duplication of IQMS constituents (Ben B. Graham, 2004; Berzher S., Giyyar S., 2003).

On the basis of earlier defined specific requirements of ST RK 1179-2003 which have to be introduced at the enterprise during creation of IQMS and the established fields of integration the analysis of the processes operating at the “Raimbek Agro” LLP on a subject of establishment of their status in the course of creation of IMS (fig. 7) was carried out.



**Figure 7.** Formation of a structure of IQMS processes  
Source: composed by the authors

The process “Document Management” is assepted to leave unchanged owing to analogousness of the requirements of ST RK ISO 9001-2016 and ST RK 1179-2003 specified during creation and work with documents. The essential distinction is in the structure and content of the documents of QMS and HACCP systems that will not be reflected on the considered process in any way.

For the processes which are subject to revision stage-by-stage decomposition of QMS of processes operating in a framework with accounting of specific requirements of the HACCP system which need to be considered for full functioning of IQMS was carried out. The HACCP system establishes tougher requirements for production of goods which is necessary to consider at “Management of Production” process decomposition in IQMS. Thus the following subprocesses “Validation”, “Prevention Cross Pollutions” and “Packing” which existence will provide observance of the specific requirements imposed by ST RK 1179-2003 to process "Management of Production" have to be added to this process.

Taken in account of the aforesaid the scheme of the process “Production Management” in IQMS meeting requirements of two standards is offered: ST RK ISO 9001-2016 and ST RK 1179-2003. The process “Providing and Management of Personnel” in a framework of IQMS is complemented with subprocess “Hygiene of Personnel”.

It should be noted that, considering possible potential danger of food products, the ST RK 1179-2003 standard gives a special attention to actions when obtaining claims with the subsequent recall of products. In this regard the process “Claims and Recall of Products”, including subprocesses “Investigation of Violations” and “Product recall” was processed.

For newly created processes requirements of the ST RK 1179-2003 standard, which establishes approach to the organization of such works and regulates the sequence of actions were taken for basic. For the processes having the status “revision” and “development” criteria for evaluation of their functioning and methods of measurement were also offered. As a result of integration of processes the uniform network of the backbone processes operating in IQMS is created.

## **Conclusions**

Results of the conducted theoretical researches and their practical realization allow making the following main conclusions:

- 1 On the basis of the carried-out analysis of trends of development of modern management an expediency of creation of the integrated quality management system for food enterprise reflecting branch specifics is established;
- 2 Theoretical and practical aspects of creation of HACCP and QMS systems are analysed, the technique of creation of the integrated quality management system is offered and the innovative project “Construction and Implementation of the Raimbek Agro LLP IQMS”, including the purpose, objectives, motives and description of stages of realization of the project is developed;
- 3 On the basis of the analysis of the international ISO 9001-2015 standard (ST RK ISO 9001-2016) and the HACCP rules (ST RK 1179-2003) and the established degrees of compatibility of their requirements the conceptual model of IQMS reflecting branch specifics of the food enterprise is offered;
- 4 On the basis of the revealed fields of integration of the HACCP and QMS systems a composite design of processes is carried out and indicators of effectiveness of processes and methods of their measurement are developed;
- 5 The network of processes of the “Raimbek Agro” LLP IQMS according to the offered mechanism of creation of the additive model is formed.
- 6 Application of the process approach at creation of IQMS taking in account the branch requirements of HACCP allowed to allocate and identify the processes operating in the QMS and HACCP systems. The analysis of the processes and subprocesses of both considered systems showed basic compatibility of QMS and HACCP owing to existence of similar processes and subprocesses, an also allowed to create uniform network of the

interconnected and interdependent processes, at the correct management of which effective and productive management of IQMS can be provided.

## References

- Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R. (2017). Towards food safety: quality management peculiarities, *Journal of Security and Sustainability Issues* 6(3): 513–522. [http://dx.doi.org/10.9770/jssi.2017.6.3\(15\)](http://dx.doi.org/10.9770/jssi.2017.6.3(15))
- Akhmetova, S.O., Omarova, A.A. (2014). Development of a technique of creation of the integrated quality management system of the food enterprise on the example of the Raimbek Agro company. *V Intern. Scientific and Pract. Conf. "Agricultural Sciences and Agroindustrial Complex at the turn of the Century"*, Novosibirsk, March 21, 2014, pp. 286-296.
- Alymbekov, K.A. (2003). The integrated quality management system: branch specifics, *Journal 'Standards and Quality'* 2: 64-65.
- Avstriyevsky A.N., Kantare V.M., Surkov I.V. (2007). Quality management at the enterprises for food and processing industry. Novosibirsk: Sib. Univ. publ. house. 268 pages. <https://www.twirpx.com/file/1710186/>
- Ben B. Graham. (2004). Detail process charting: speaking the language of process - John Wiley & Sons Ltd, 2004. - 208 p.
- Berzher S., Giyyar S. (2003). Graphic description of processes. Technique and Technical Means. Translation from french. - N. Novgorod: SMTs "Priority", 2003.-250 p. [zipsites.ru/me/it/Sedrik\\_Berzher...](zipsites.ru/me/it/Sedrik_Berzher...)
- Bojkovska K., Tomovska J., Mohammad Ali Shariati (2014). Contemporary Quality Management System Elements in the Food Industry, *VestnikOrelGAU* 6(51): 48-50. <cyberleninka.ru/article/n/...>
- Chris Bamber, John Sharp, Mick Hides. (2002). The role of the maintenance organization in an integrated management system, *Managerial Auditing Journal* 17(1/2): 20-25. <ijssr.org/pdf/155.pdf>
- Conti, T. (2005), Quality in the XXI century. A quality role in ensuring competitiveness and a sustainable development. - M.: RIA "Standards and Quality", 280 p.
- David K. Watkins. (2006). Reflection on the future of quality, *Quality Progress* 13(1): 23-28.
- FMCG-PP-6001 Quality manual of Raimbek Agro LLP
- ISO 9001:2015. Quality management systems – Requirements <https://www.iso.org/standard/45481.html>
- Lafta J.K. (2007). Efficiency of management of the organization. Manual. M.: Russian business literature. 237 p. <https://www.twirpx.com/file/549019/>
- Maximov, Yu.A., Papkov, V.I. (2003). QMS as means of increase of competitiveness and efficiency of the enterprise, *Quality Management Methods* 11: 9-14.
- Rodionova Yu.A. (2013). Organization of assessment and monitoring of a quality management system of the enterprise. Abstract of the dissertation, St. Petersburg. 18 p.
- Shalaev A.P. (2006). Industry standards on a quality management system: prospects of development, *Standards and Quality* 5: 62-64. <http://library.karelia.ru/catalog/nlibr>
- ST RK 1179-2003. Quality System. Foodstuff Quality Management on the basis of the principles of HACCP. General Provisions. [info@naceks.kz](mailto:info@naceks.kz)
- ST RK ICO 9001-2016 Quality management systems - Requirements. <https://www.iso.org/standard/45481.html>
- Svitkin, M.Z. (2004). The Integrated Management Systems, *Standards and Quality* 2: 6-61. <journal.tltsu.ru/rus/index.php/...>

Tvaronavičienė, M., Tarkhanova, E., & Durglishvili, N. (2018). Sustainable economic growth and innovative development of educational systems, *Journal of International Studies* 11(1): 236-244. <https://doi.org/10.14254/2071-8330.2018/11-1/19>

Ungan Mustafa C. (2006). Standardization through process documentation, *Business Process Management Journal* 12(2): 135-148.

Yefimov V.V. (2009). Means and methods of quality management: manual. M.: KNORUS. 232 p. <http://www.docplayer.ru/56430230>

Zamyatina, O.V. (2006). Safety of food and medical equipment, Quality control of food products based on the principles of HACCP. Translation from English - M.: RIA "Standards and Quality", 2006. – 232 p. <hse.ru/data/2014/05/07/...>

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**SUSTAINABLE DEVELOPMENT OF INDUSTRY 4.0:  
THE CASE OF HIGH-TECH PRODUCTS SYSTEM DESIGN\***

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**Abstract.** Modern production of high-tech products is characterized by the transition from the traditional design paradigm to the new paradigm of designing a holistic unified set of products. In this regard, the process of designing high-tech products needed to be allocated into a separate type – the system design. Its main methodological provisions are presented in the study. The result of the generalization was the developed system design model, which included the engineering design and process design stages, a method for evaluating the unification effectiveness, suitable for use at both intraspecific and trans-species levels, and an algorithm for the practical use of an integrated model and proposals for its use at the stages of creation of high-tech products. The use of the methodological toolkit for system design of high-tech products allows reducing the cost of their creation, production and operation significantly, as well as obtaining the structure of production with balanced efficiency and cost. The practical implementation of the proposed tools is possible at the stage of selecting design organizations. The developed toolkit is universal and can be used in all sectors of the economy.

**Keywords:** system design, Industry 4.0, high-tech products, production structure, sustainability, production model optimization.

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## 1. Introduction

Re-industrialization is a central component of the modern model of economic development, with the high-tech sector (Industry 4.0) being its basis, where priority is given to the digital industry, robotization, and the creation of innovative products (Romanova *et al.*, 2017). The traditional way of creating any technical product involves the development and implementation of a number of design and regulatory documents. Timely development of these documents allows proceeding with the manufacture of the product. Although it was considered acceptable to have the development of a separate specific high-tech product with the best technical and economic characteristics as the end result of a traditional design scheme quite recently, at the present time such an approach is no longer relevant.

The feasibility of developing a product is closely linked to the tasks of creating a set of unified products, as well as the requirements of customers to their properties. Moreover, these requirements are formulated taking into account, on the one hand, the possibility of creating a scientific and technical reserve, and on the other, the possibility of establishing the optimal parameters of the structural and technological scheme of high-tech products. The consideration of the above-mentioned aspects is not sufficiently ensured by the traditional design methods used (Batkovskiy *et al.*, 2016). Solving the problem of choosing the characteristics and the design and technological appearance of high-tech products is carried out by optimizing their parameters through a set of individual tasks. Often, the search for a solution is carried out in a heuristic way or, at best, on the basis of expert estimates. In this regard, the process of designing high-tech products needed to be allocated into a separate type – the system design.

For the above purpose, the article consistently addresses the following issues: the principle of consistency and the formal logic of its use; an integrated model of system design, which includes the stages of engineering design and process design and a method for evaluating the effectiveness of unification at these stages; an algorithm for the practical implementation of an integrated model and proposals for its use in the creation of high-tech products. The practical application of the proposed tool will significantly reduce the cost of creating, manufacturing and operating high-tech products and also let obtain the structure of production with balanced efficiency and cost.

## 2. Literature review

The results of the analysis showed that the problems associated with the design of high-tech products have been studied quite extensively by now (Sobolev, & Solovev, 2017). Moreover, in many works, the process of designing high-tech products is considered as part of an emerging product lifecycle management system (Golosovskii *et al.*, 2014). These and a number of other works highlighted the design features of high-tech products, including (Baikin, & Stetsyuk, 2014; Astakhov *et al.*, 2015): the need to justify the level of the most significant product characteristics; the formation of a variety of options for the functional construction of the designed products; conducting technical and economic assessments of the designed products.

A number of works in the field of designing high-tech products made it possible to establish that there is certain regularity in the process of implementing the stages of the project for creating high-tech products. It was revealed that the distribution of different stages of work can be represented as a logistic distribution (Sobolev, & Solovev, 2017). Various aspects of a probabilistic description of the development process of technical products based on a



logistic model are provided (Demchenko, 2014). The logistic model is currently presented as one of the main regularities of the economic performance of high-tech products (Kaluzhskii, 2014). This distribution is often observed in the economy, production, and technology. Optimization models of economic performance in the conditions of uncertainty and risk, including methodological issues of problem statement and mathematical methods for solving and analyzing them, are considered (Shilova, 2014). Some scientists have touched on the problem of optimizing the research and development strategy in the field of new technologies. The questions of self-organization of economic performance models, the method of inductive self-organization, in particular, are researched. The works of scientists in which the trends in the development of CALS technologies in the production of various products are investigated (Alieva, 2017) are of outstanding interest; a dynamic model of quality management of product design in mechanical engineering (Panov, & Trofimova, 2017); prospects for the use of mathematical modeling and digital design in ensuring product life cycle management (Tikhonov, & Sazonov, 2018); methodological issues of developing strategies for the promotion of high-tech products (Goraeva, 2015); approaches to evaluating the effectiveness of investment in innovative projects (Vilenskiy *et al.*, 2015).

However, despite the wide range of individual issues studied in the field of design, the system methodology for designing high-tech products is not sufficiently developed. The issues related to the substantiation of the optimal nomenclature and rational characteristics of high-tech products, as well as analysis and evaluation of the possibilities of unification, justification of the choice of rational options for the design-technological appearance of high-tech products (Kazanskaya, & Palenova, 2015) remain unresolved. These circumstances have led to the need to improve the existing design tools for high-tech products.

The most significant contribution to solving the problems under consideration was made by the following researchers on the rationale for making rational decisions in the process of financing the development of high-tech products and new technologies (Calderon *et al.*, 2015); methodical approaches to estimating and managing costs (Ely *et al.*, 2014; Kamae *et al.*, 2015; Hilkevics, Semakina, 2019); the use of a flexible development methodology to accelerate and improve the efficiency of innovative development by increasing the involvement and more efficient use of the creative potential of the team (Langdon *et al.*, 2014); analysis of the patterns of innovation development and the strength of its influence on the activities of companies through the phenomena of “disruptive innovations” and “closing” technologies (Christensen, & Clayton, 2016); The impact of risk management on the cost of a high-tech product development project was considered (Allen *et al.*, 2015; Harris *et al.*, 2017; Dubrovsky *et al.*, 2011). The approaches to assessing the effectiveness of innovative projects in the field of high technologies with linguistic variables (Vlasov *et al.* 2017, 2018) were proposed.

The analysis showed that the main limitations in the use of these approaches are: industry-specific limitations; the need to adapt to different economic realities; orientation to some single factor in the creation of high-tech products and their market promotion, difficulties in obtaining source data, etc. (Bessant *et al.*, 2015). These restrictions significantly complicate the comprehensive assessment of the possibility of implementing projects to create high-tech products within a given time, especially in risk, in relation to Russian enterprises as well (Batkovski *et al.*, 2015). Thus, the toolkit and the design models for high-tech products have not been adequately considered from a system perspective.

### 3. Methods

#### 3.1. The principle of consistency in the design of high-tech products

The complexity and multiplicity of the task of the system design of high-tech products required the creation of uniform methodological foundations. The introduction of the principle of consistency required an appeal to the

hierarchical procedures for solving problems, using a set of uncoordinated criteria, which objectively led to the emergence of a number of problems.

1. Linking targets for all levels of high-tech products. In a generalized form, the model of gradual creation of high-tech products should be presented as the following:

$$S = \begin{cases} f_1 : S \rightarrow S_{21} \\ f_2 : S \rightarrow S_{32} \\ \dots \\ f_{N-1} : S \rightarrow S_{N,N-1} \\ f_N : S \rightarrow S^* \end{cases}, \quad (1)$$

where  $S^*$  is the area of global targets;  $S_{21}$  – the scope of targets formulated in the second stage of creating high-tech products for the first one;  $S_{32}$  – the scope of targets formulated in the third stage for the second;  $S_{N,N-1}$  – the scope of targets formulated at the  $N$ -th stage for the  $N-1$ st stage.

2. The next problem of introducing the principle of consistency is related to the fact that the indicators used in the feasibility study relate to different subject areas and have a different physical nature, reliability, and methods of assessment.

3. Estimation of cost indicators presents severe difficulties associated with identifying a multitude of analytical dependencies in various economic conditions.

The following algorithm is proposed for solving the problems considered. First, a set of indicators ( $Q$ ) is introduced, reflecting the state of high-tech products at various stages of their creation, defined at the time point  $t$ :

$$Q(R_u) = \{q_i^t\}, i = 1, \dots, M, \quad t = 1, \dots, T, \quad (2)$$

where  $R_u$  is an indicator of the level of resource support for the creation of high-tech products;  $q_i^t$  – the value of the  $i$ -th indicator at the  $t$ -th point in time.

The required formation of the appearance of high-tech products during the budget period can be presented as its planned development pathway. For this set,  $Q$  and  $S$  must be one-to-one (each element  $q_i^t$  of the set  $Q$  corresponds to a certain element  $s$  of the set  $S$ ).

As an indicator of the effectiveness of the development of high-tech products, it is advisable to take the degree of its state approaching the required appearance as:

$$W(R) = Q_{mp} - Q(R), \quad (3)$$

where  $Q_{mp} = \{q_{mpi}^t\}$  is a set of indicators describing the parameters of the desired appearance of high-tech products to a specific point in time;  $Q = \{q_i^t\}$  – a set of indicators describing the achieved appearance of high-tech products to a specific point in time.

Considering the above, the generalized indicator will look like:

$$W(R) = \begin{vmatrix} \Delta w_1^1 = q_{mp1}^1 - q_1^1 & \dots & \Delta w_1^T = q_{mp1}^T - q_1^T \\ \dots & \dots & \dots \\ \Delta w_M^1 = q_{mpM}^1 - q_M^1 & \dots & \Delta w_M^T = q_{mpM}^T - q_M^T \end{vmatrix}. \quad (4)$$

In turn, the size of the deviation of each indicator ( $\Delta w_i^t$ ), which characterizes the appearance of high-tech products, depends on the level of support ( $r_i^t$ ) for the measures. The development level of high-tech products depends on the level of resource provision:

$$W(R_u) = \{\Delta w_i^t = q_{mpi}^t - q_i^t(r_i^t)\} = Q_{mp} - Q_t, \quad (5)$$

where  $r_i^t$  is the level of resource support for the  $i$ -th aspect of the operation of high-tech products in the  $t$ -th year;

$R_u = \sum_{t=1}^T \sum_{i=1}^M r_i^t$ ;  $Q_{mp} = \{q_{mpi}^t\}$  – a set of indicators characterizing the desired appearance of high-tech products by the

time  $t$ ;  $Q_t = \{q_i^t\}$  – a set of indicators characterizing the achieved appearance of high-tech products by the time  $t$ .

The formulated provisions make it possible to determine the influence of the principle of consistency on the creation of high-tech products as an insurance of the minimum deviation of the achieved technical appearance of the product from the required one at different points of time with appropriate resource support. The introduction of the principle of consistency can minimize the  $V(R_u)$  function describing the number of indicators of the appearance of high-tech products that have exceeded the permissible levels of values. Given the above, the function will take the following form:

$$V(R_u) = \sum_{t=1}^T \sum_{i=1}^M (g_i \cdot w_{it}^{on}(r_i^t)) \rightarrow \min_r, \quad (6)$$

where  $V(R_u)$  is the function of changing the size of the effect from the level of resource provision  $R_u$  when

introducing the principle of consistency;  $R_u = \sum_{t=1}^T \sum_{i=1}^M r_i^t$  – the total cost of creating high-tech products within the planned period;  $g_i$  is the weight of the  $i$ -th parameter in terms of describing the appearance of high-tech products  $\sum_{i=1}^M g_i = 1$ .

It is advisable to calculate the critical deviation of the  $i$ -th parameter at the  $t$ -th moment of time using the following formula:

$$w_{it}^{on}(r_i^t) = \begin{cases} 1, & \Delta w_i^t < \Delta w_{idop}^t \\ 0, & \Delta w_i^t > \Delta w_{idop}^t \end{cases} \text{ at } C \leq L = f(S, \Delta w_i^t), \quad (7)$$

where  $C$  is the total cost of creating high-tech products in the planning period;  $L$  – appropriations limits;  $\Delta w_{idop}^t$  – tolerance of the  $i$ -th indicator of the appearance of high-tech products.

In this case, the elements of the  $\Delta w_i^t = q_{mpi}^t - q_i^t$  matrix become controlled parameters. With the known dependencies  $\Delta w_i^t = F(r_i^t)$ , the solution of the problem can be simplified, since it is possible to determine the values of the indicator describing the development trends of high-tech products ( $W$ ) at various levels of resource provision.

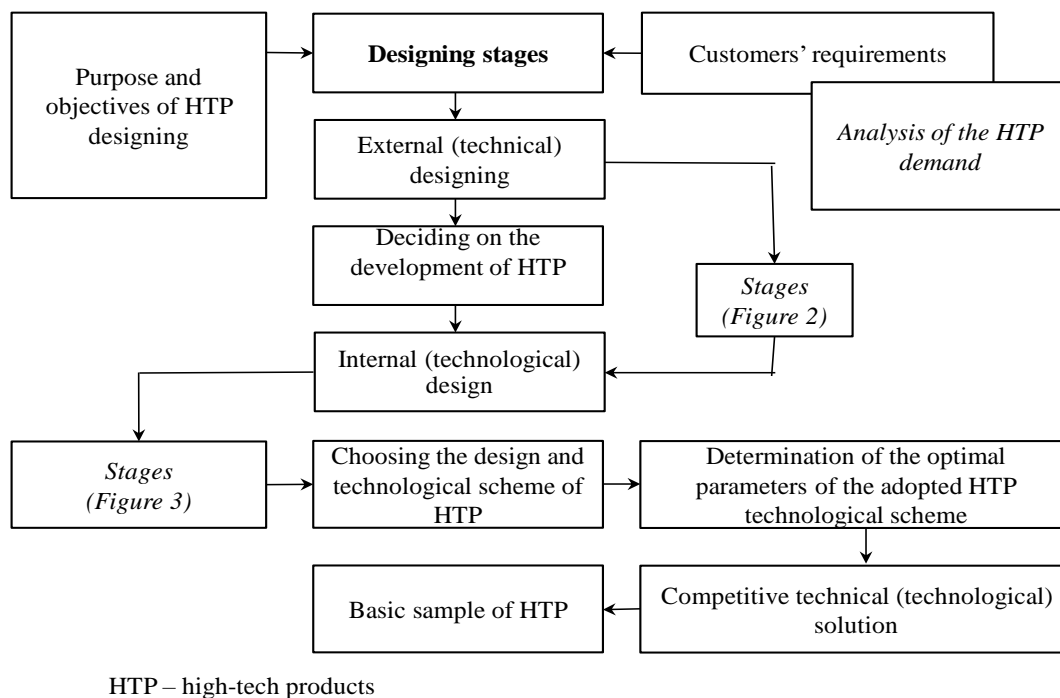
### 3.2. Design model

In order to formalize the tasks of system design and sound choice of characteristics, the authors will present the entire set of high-tech products with the following set:

$$N_{VTP} = \{N_1, N_2, \dots, N_k\}_{OPT}, \quad (8)$$

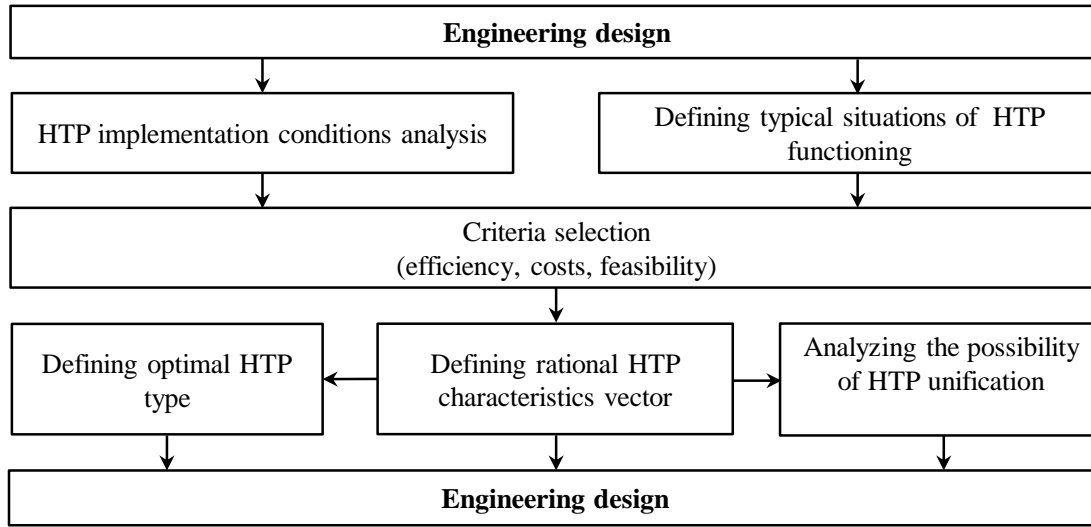
where  $N_1, N_2, \dots, N_k$  are subsets (types) of high-tech products.

The optimal set of articles of high-tech products of the (8) form should take into account the needs of various customers, the purposes and objectives of the operation of high-tech products in various economic conditions. The described task is advisable to be completed in several stages. An integrated model of high-tech system design is shown in Figure 1.



**Fig. 1.** Model of high-tech products system design

The practice of designing high-tech products shows that the degree of contribution of each stage to the overall result (as well as the value of the stages) increases from the final stage to the initial one (Sobolev, & Solovev, 2017). This pattern is characteristic of both engineering and process design. Further, the contents of the engineering (Figure 2) and process (Figure 3) design stages are considered.



**Fig. 2.** Stages of high-tech products engineering design

Based on the needs of various customers of high-tech products and on the basis of the analysis of possible intersections of  $N_1, N_2, \dots, N_k$  subsets, an optimal (minimum) type of products created in the course of research and development work is determined:

$$N_{VTR} \cap \{N_{1(1)}, N_{2(2)}, \dots, N_{k(l)}\}, \quad (9)$$

where  $N_{1(1)}, N_{2(2)}, \dots, N_{k(l)}$  are the subsets of high-tech products, developed in the interests of various customers.

In this case, the possibility of unification of the products under development is analyzed. The implementation of such a possibility requires an intersection (9) and the preconditions of the following associations:

$$\{n_1, n_2, \dots, n_k\} \in N_{VTP(1)} \cup \{n_1, n_2, \dots, n_k\} \in N_{VTP(2)} \cup \dots \cup \{n_1, n_2, \dots, n_k\} \in N_{VTP(l)} \quad (10)$$

when:

$$\begin{aligned} |K(N_{VTP(1)}) - K(N_{VTP(2)})| &\leq K_{dop} \\ |K(N_{VTP(l-1)}) - K(N_{VTP(l)})| &\leq K_{dop} \end{aligned} \quad (11)$$

where  $n_1, n_2, \dots, n_k$  are the elements of the subsets  $N_1, N_2, \dots, N_k$ , respectively;  $K$  is the optimal solution for every  $N_{VTP(i)}$ ;  $K_{dop}$  – permissible deviation from the optimal solution.

The choice of the rational characteristics of high-tech products may be represented as a process of sub-optimization of the system (8) subject to conditions (9), (10) and (11). The procedure for selecting rational characteristics should be reduced to solving the problem of matching the elements to their associations, which can be represented in the following form:

$$\begin{aligned} n_1 \in N_1; n_2 \in N_2; \dots n_l \in N_l \\ \cup(n_1; n_2; \dots n_l)_{\max} = \max K \end{aligned} \quad (12)$$

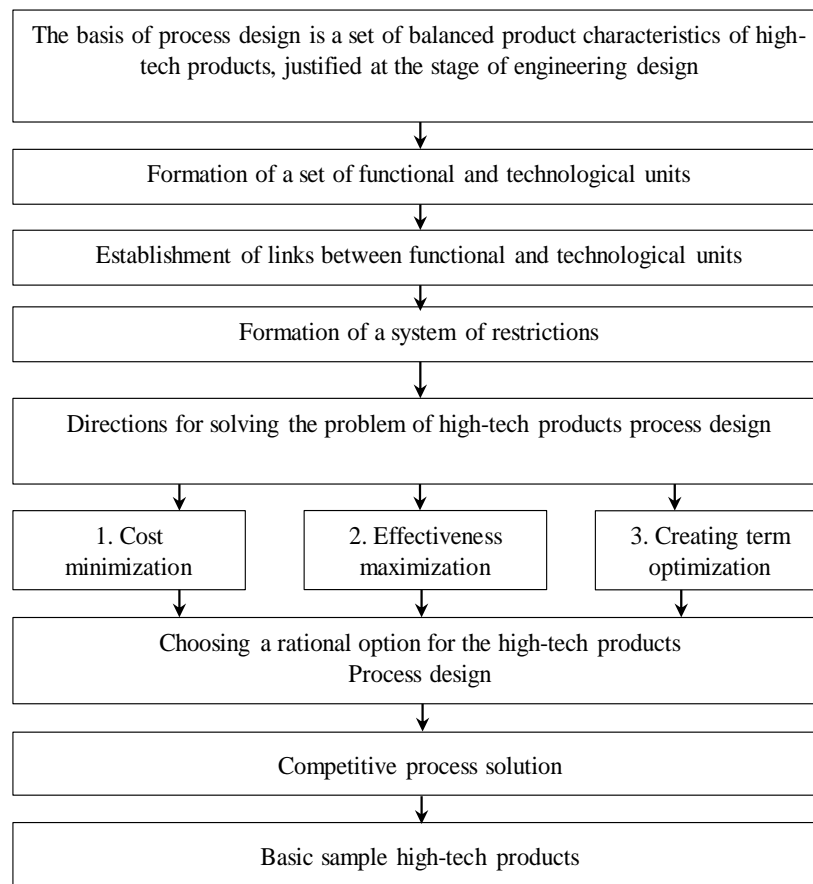
Based on a constructive analysis of a sample of high-tech products, subsets of alternative technical solutions are formed:

$$A_1^* \cup (n_1^*; n_1^*; \dots n_l^*) = K_{zad}, \quad (13)$$

where  $n_1^*; n_1^*; \dots n_l^*$  are the elements forming alternative technical solutions  $A_1^*$ ; some given criterion level  $K_{zad}$ .

The formed subsets of alternative technical solutions (13) provide the basis for the formulation of the problem of synthesizing the design and technological scheme of a high-tech product. The essence of this task consists in the formation of variants of elements combination under the condition of their existence in various constraints, under which a certain specified level of the criterion  $K_{zad}$  (Esev *et al.*, 2014) is provided. The task of synthesizing the design and technological scheme of a high-tech product is solved at the stages of process design.

The purpose of process design is the synergistic combination of various functional-technological elements (units) into a single scheme (Garina *et al.*, 2017). This procedure contains the following as unknown parameters: types and number of functional elements (units), their level of development, communication between elements (units) to achieve the required values of the final product characteristics (Kazakova, & Saveleva, 2014).



**Fig. 3.** Stages of high-tech products process design

Within the framework of process design, additional requirements are imposed on functional-technological (elements) units, such as: standardization, unification of elements; terms of the application of borrowed elements of a similar or another functional purpose (Skhirtladze *et al.*, 2015).

When developing high-tech products, special attention is paid to measures for the unification of components (Tretiakov, 2014). In this case, an assessment of the level of unification is usually carried out on the basis of a well-known approach using particular unification indicators (Borisov, & Borisov, 2016).

As part of this study, a new method for assessing the level of unification has been proposed, based on a generalizing measure of the unification effectiveness. It is assumed that this ratio shows the change in the efficiency of the designed piece of high-tech products relative to some basic product at an equal level of costs for the performance of any task in their functional purpose. This ratio is determined by the following dependency:

$$K_e = \frac{P^p}{P^b}, \quad \text{with } C^p = C^b, \quad (14)$$

where  $C^p$ ,  $C^b$  are the costs of performing the task in its functional purpose by the designed and by the basic piece of high-tech products, respectively;  $P^p$ ,  $P^b$  are the probabilities of accomplishing the task by the designed and basic articles of high-tech products, respectively.

In addition, it is assumed that the creation of high-tech products includes the development and production of their component parts. The task of determining the cost of manufacturing high-tech products is more complex. In this regard, it is assumed that only a certain percentage of consumers from their total number will be provided with developed high-tech products and in accordance with the standard membership of high-tech products in order to estimate the approximate level of production costs.

Based on this approach, the assessment of the level of product unification of high-tech products is carried out according to the following:

$$K_u = \frac{\sum_{p=1}^k C_p^u - \sum_{q=1}^l \Delta N_q^u \cdot C_q^u}{\sum_{p=1}^k C_p^o} \quad (15)$$

where  $C_p^u$ ,  $C_p^o$  are the costs of the  $p$ -th stage of designing a unified and non-unified versions of high-tech products, respectively;  $\Delta N_q^u$  is a possible increase in production volumes for the considered period of time of the  $q$ -th standardized component (element) of a high-tech product;  $C_q^u$  is the profit from the use of  $q$ -th unified component (element).

Taking into account the duration of the life cycle of a high-tech product and the formula (15) for the  $q$ -th unified component (element), it is advisable to use the following expression:

$$K_u = \frac{C_q^u}{C_q^o} \left( 1 - \frac{\Delta N_q^u}{N_q^o} \right), \quad (16)$$

which allows formula (14) to be expressed as:

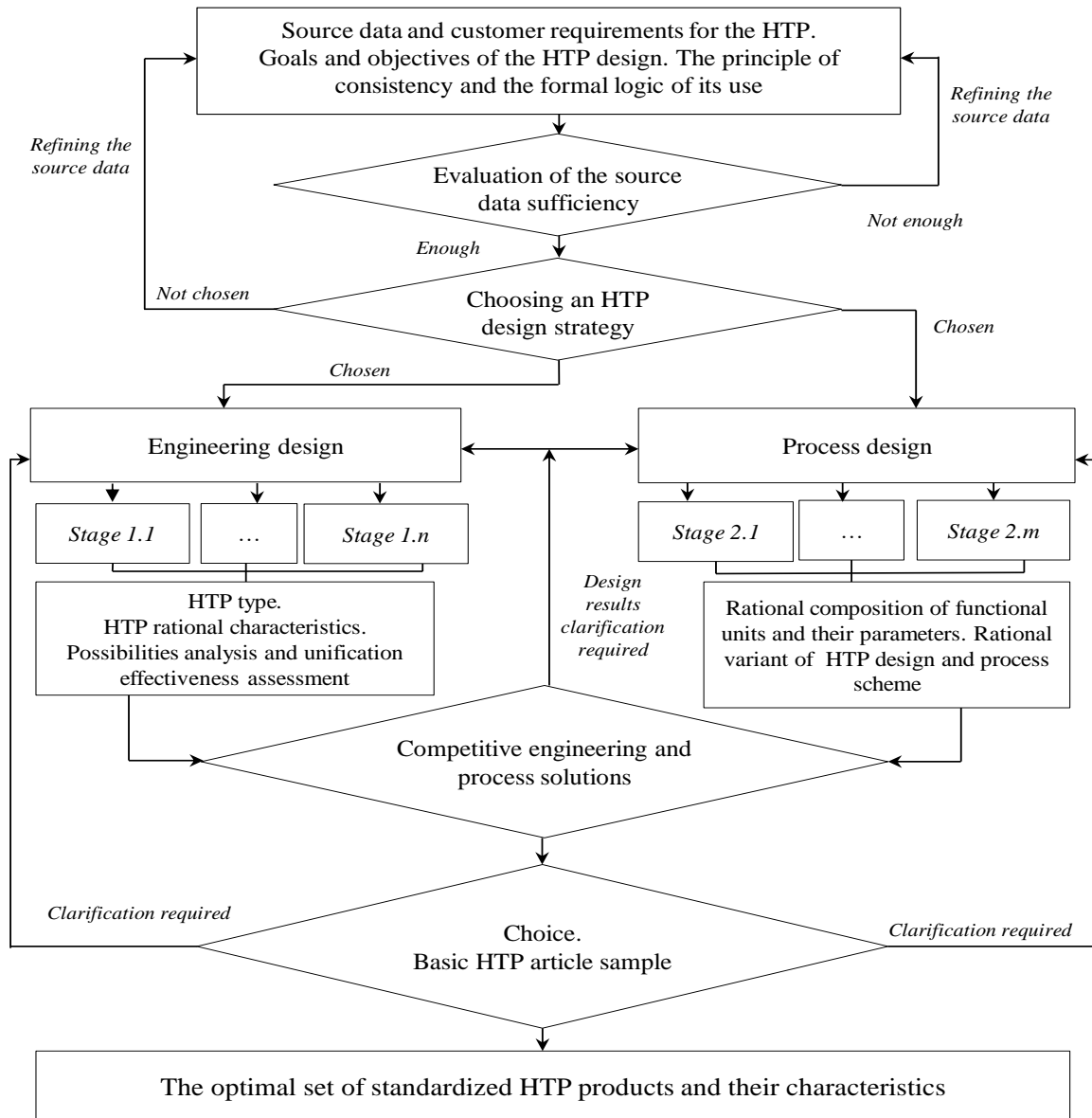
$$K_e = F(K_u, \alpha_q^u, \beta^o), \quad (17)$$

where  $\alpha_q^u$ ,  $\beta^o$  are the generalized characteristics of non-unified and unified components (elements);  $N_q^o$  is the total volume of production of the  $q$ -th component (element) of a high-tech product (as the sum of standardized and non-standardized components) for the considered period of time.

According to expression (17), there is a close relationship between the  $K_e$  efficiency coefficient and the unification factor  $K_u$ , which should be taken into account when choosing a rational option for the structural and technological scheme of a high-tech product.



Taking the considered features of engineering and process design into account, as well as evaluating the effectiveness of unification measures, an algorithm for the practical use of an integrated model for system design of high-tech products is proposed (Figure 4).



**Fig. 4.** Practical use algorithm for the integrated model of the high-tech products system design

A basic sample of a high-tech product and an optimal combination of such products are developed based on the choice of competitive engineering and process solutions. Thus, the proposed integrated model is aimed at justifying the required values of the designed products indicators and can be widely used in various sectors of the economy.

#### 4. Results and Discussion

On the basis of the reviewed methodology of engineering design, it is possible to substantiate on a scientific basis the constructive-technological appearance of promising high-tech products, including: moving from a balanced system of requirements for high-tech products to a specific composition of functional-technological units, i.e. determine their rational composition in the designed high-tech product. This task is formulated using the complex “efficiency – cost – feasibility” criterion in three variants of the problem statement: cost minimization; efficiency maximization; optimization of the timing of the creation of high-tech products.

System design is an effective methodological toolkit for optimizing efforts and resources for the development and manufacture of high-tech products while meeting the specified requirements for their properties and efficiency. The demand for system design is largely ensured by the integrated implementation of the principle of consistency in the formation of the system structure of high-tech products and of the appearance of specific items of high-tech products. The developed methodological toolkit should be used in planning agencies to assess the capabilities of design organizations and enterprises in executing orders for the creation of high-tech products.

As the practice approbation of the use of the developed toolkit, the authors consider a hypothetical high-tech product, the design of which is supposed to be carried out using one of 5 competing options (Table 1).

**Table 1.** Options for constructing a sample of high-tech products

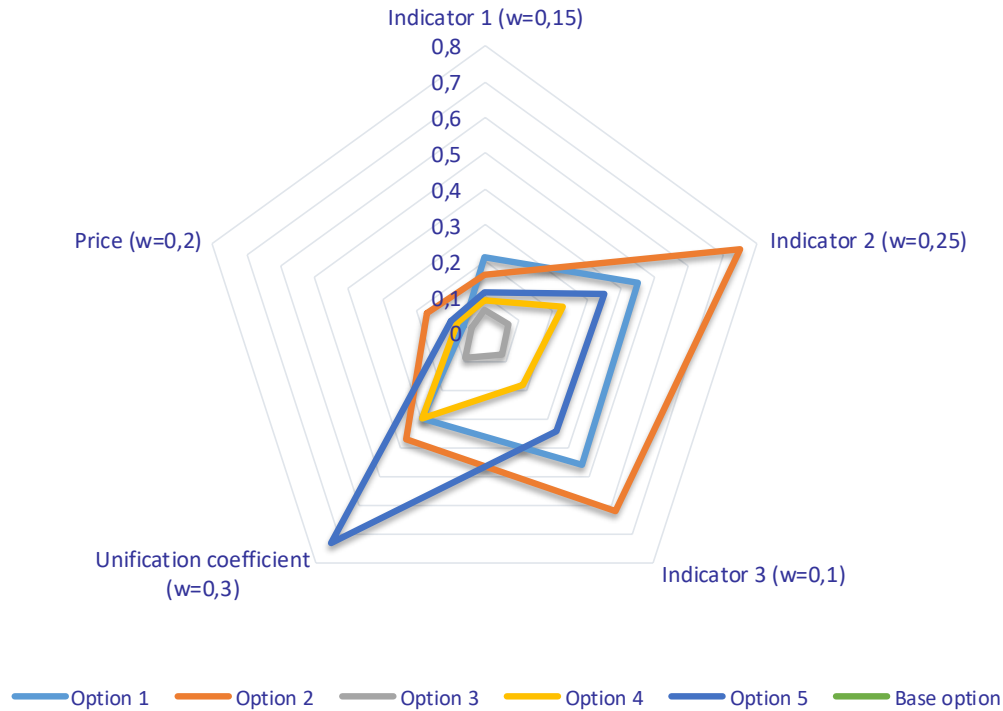
Production sample design options	Indicator 1 (w=0.15)	Indicator 2 (w=0.25)	Indicator 3 (w=0.1)	Unification coefficient (w=0.3)	Price (w=0.2)
Option 1	79	41	49	49	127
Option 2	84	19	34	44	140
Option 3	94	80	83	76	115
Option 4	109	58	74	49	130
Option 5	89	49	59	19	132
Base option	100	75	90	70	200

Within the framework of the task set, it is necessary to choose such an option for constructing a projected sample of high-tech products that is closest to the base variant. With the use of the developed toolkit, further technical and economic analysis of options for constructing competing samples of high-tech products is carried out. In order to do this, the degree of approximation of the indicators for constructing samples of high-tech products to the indicators of the base sample is calculated. The results of the calculations are shown in Table 2.

**Table 2.** Results of the calculation of the degree of approximation of the indicators of options for constructing samples of high-tech products to the indicators of the base sample

Production sample design variants	Relative value				
	Indicator 1 (w=0.15)	Indicator 2 (w=0.25)	Indicator 3 (w=0.1)	Unification coefficient (w=0.3)	Price (w=0.2)
Option 1	0.21	0.45	0.46	0.30	0.06
Option 2	0.16	0.75	0.62	0.37	0.17
Option 3	0.06	0.07	0.08	0.09	0.04
Option 4	0.09	0.23	0.18	0.30	0.08
Option 5	0.11	0.35	0.34	0.73	0.10
Base option	0	0	0	0	0

In order to conduct a feasibility analysis of options for constructing competing samples of high-tech products based on the data in Table 2, a petal diagram is constructed (Figure 5).



**Fig. 5.** Petal diagram characterizing the results of the feasibility analysis of options for constructing competing samples of high-tech products

Further comes the analysis of the results obtained using the ideal point method. It is apparent from Figure 5 that the closest to the basic variant (by all indicators) is option 3; therefore, it is advisable to design an advanced sample of high-tech products according to this variant. The remaining construction options have worse performance and require large resources to implement their design.

In general, the use of the system design methodical toolkit allows reducing the resource costs for the creation and manufacture of high-tech products and obtaining a balanced structure of the baseline items of high-tech products.

## Conclusions

In modern scientific research, the designing of high-tech products is considered mainly in relation to individual products and much less often as the design of a set of high-tech products to meet the needs of different customers and be used in different operating conditions. Even less often, when designing high-tech products, measures to unify the component parts and elements of products are considered. That is why in this paper it was necessary to isolate and investigate from a system standpoint the designing of high-tech products with specified properties as part of a lifecycle management system.

The study found out that the system design of high-tech products is a methodology of structural-parametric synthesis. Parametric synthesis consists in determining the optimal dynamic parameters of the design and technological scheme of a high-tech product based on forming an acceptable set of alternative high-tech products and the choice of the dominant technological solution. Structural synthesis involves the development of a set of high-tech products, taking into account the environment, the conditions of operation of high-tech products, the requirements for them and the new technical solutions.

As a result, a methodical toolkit for system design of high-tech products has been developed. The main elements of the developed model are: stages of engineering design; stages of process design; method of evaluating the unification effectiveness, suitable for use at both intraspecific and trans-species levels; and an algorithm for the practical use of an integrated model and proposals for its use at the stages of high-tech products creation.

The developed toolkit is advisable to be used in planning units in order to assess the capabilities of design organizations and enterprises in executing orders for the creation of high-tech products. Further improvement of the system design methodology should be aimed at achieving minimum costs or maximum efficiency at specified costs, taking into account the possibilities of unification in the design of high-tech products.

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### References:

- Alieva, E.V. (2017). Cals-Technologies, Implementation of Case-Technologies in Production. *NovaInfo*, 58(5), 61-68. Retrieved March 19, 2019 from <https://novainfo.ru/article/10822>
- Allen, M., Carpenter, C., Hutchins, M., & Jones, G. (2015). Impact of Risk Management on Project Cost: An Industry Comparison. *Journal of Information Technology & Economic Development*, 6(2), 1-19.
- Astakhov, S.A., Shiryaev, A.N., & Vorobev, A.A. (2015). Organization of Process Management of the Life Cycle of Products of Highly Specialized Enterprises. *Trends and Management*, 4, 423-432. <https://doi.org/10.7256/2307-9118.2015.4.16086>
- Baikin, V.A., & Stetsyuk, A.N. (2015). Formalization of Technological Procedures for Monitoring the Life Cycle of a Complex Engineering System. *Software Systems and Computational Methods*, 1, 52-58. <https://doi.org/10.7256/2305-6061.2015.1.14407>
- Batkovskiy, A.M., Konovalova, A.V., Semenova, E.G., Trofimets, V.Ya., & Fomina, A.V. (2015). Risks of Development and Implementation of Innovative Projects. *Mediterranean Journal of Social Sciences*, 6(4), S4, 243-253. <https://doi.org/10.5901/mjss.2015.v6n4s4p243>
- Batkovskiy, A.M., Semenova, E.G., Fomina, A.V., Khrustalev, E.Iu., & Khrustalev, O.E. (2016). The Methodology and Mathematical Tools to Assess and Mitigate the Risk of Creating High-Tech Products. *Indian Journal of Science and Technology*, 9(27), 242-252. <https://doi.org/10.17485/ijst/2016/v9i28/97659>
- Bertoni, F., Croce, A., & Guerini, M. (2015). Venture Capital and the Investment Curve of Young High-Tech Companies. *Journal of Corporate Finance*, 35, 159-176. <https://doi.org/10.1016/j.jcorpfin.2015.08.012>
- Bessant, J., Trifilova, A., & Rush, H. (2015). Crisis-Driven Innovation: The Case of Humanitarian Innovation. *International Journal of Innovation Management*, 19(06). <https://doi.org/10.1142/S1363919615400149>
- Borisov, V.M., & Borisov, S.V. (2016). Assessment of the Level of Standardization and Unification of Engineering Products. *Bulletin of Technological University*, 19(3), 93-94.
- Calderon, M., Salvatierra, O.A., & Roording, R. (2015). The New Technology Cost-Effectiveness Checklist: Introducing A Practical Guideline for the Selection of Health Technologies. *Value in Health*, 18(7), A569. DOI: <http://dx.doi.org/10.1016/j.jval.2015.09.1871>
- Christensen, A., & Clayton, M. (2016). *The Innovator's Dilemma* (1st ed.). Boston, Mass.: Harvard Business Review Press. (p. 239).

- Demchenko, A.I. (2014). Process-Oriented Approaches to the Design and Modeling of Logistics Chains. *Bulletin of the South Ural State University. Series: Economics and Management*, 8(4), 169-178. Retrieved March 19, 2019 from <http://vestnik.susu.ru/em/article/view/2890/273>
- Dubrovsky, V.Zh., Dulova, I.N., & Kuzmin, E.A. (2011). Financial Risk Assessment in Cash Flow Forecasts for a Multi-Product Enterprise. *Chelyabinsk State University Bulletin*, 6(221), Economy, Issue 31, 100-107.
- Ely, A., Van Zwanenberg, P., & Stirling, A. (2014). Broadening out and Opening up Technology Assessment: Approaches to Enhance International Development, Co-Ordination and Democratisation. *Research Policy*, 43(3), 505-518. <http://dx.doi.org/10.1016/j.respol.2013.09.004>
- Esev, A.A., Merezhko, A.N., & Tkachuk, A.V. (2014). Technology Qualimetry Technical Level of Complex Systems. *Bulletin of Computer and Information Technology*, 7(121), 28-34. <https://doi.org/10.14489/vkit.2014.07.pp.028-034>
- Garina, E.P., Kuznetsov, V.P., Romanovskaya, E.V., Lapaev, D.N., & Yashin, S.N. (2017). Formation of the Production System Elements and R&D Product Development Processes in the Early Stages of the Project. *Journal of Applied Economic Sciences*, 12(2(48), 538-542.
- Golosovskii, M.S. (2014). The Model of the Life Cycle of Software Development in the Framework of Research. *Automation. Modern Technologies*, 1, 43-46.
- Goraeva, T. (2015). Methods of Forming a Strategy for Promoting High-Tech Products. *Science and Innovation. The National Academy of Sciences of the Republic of Belarus*, 12(154), 52-56.
- Harris, D., Villadsen, B., & Koble, L. (2017). *Risk and Return for Regulated Industries* (1st ed.). Elsevier Academic Press. (p. 354).
- Hilkevics, S., Semakina, V. (2019). The classification and comparison of business ratios analysis methods. *Insights into Regional Development*, 1(1): 48-57. [https://doi.org/10.9770/ird.2019.1.1\(4\)](https://doi.org/10.9770/ird.2019.1.1(4))
- Kaluzhskii, M.L. (2014). Economic Dynamics: Institutions, Systems and Self-Organization. *Economic Analysis: Theory and Practice*, 5(356), 27-38.
- Kamae, I., Sugimoto, T., & Yamabe, K. (2015). Value-Based Pricing Scheme for New Technology in Consideration of Cost-Effectiveness Dominance to the Control. *Value in Health*, 18(7), A732. <http://dx.doi.org/10.1016/j.jval.2015.09.2796>
- Kazakova, N.V., & Saveleva, I.V. (2014). Enterprise Planning Based on a Synergistic Approach. *Economy and Entrepreneurship*, 1-2(42), 581-584.
- Kazanskaya, G.N., & Palenova, T.V. (2015). Standardization – the Basis of Product Quality. *Economy and Entrepreneurship*, 5-1(58), 846-849.
- Langdon, M., Ma, M., & Wu, P.C. (2014). *Agile Innovation: The Revolutionary Approach to Accelerate Success, Inspire Engagement, and Ignite Creativity*. John Wiley & Sons. (p. 400).
- Panov, A.Yu., & Trofimova, M.S. (2017). Dynamic Model of Quality Management for Designing Machine Tools. *Bulletin of the Perm National Research Polytechnic University. Electrical Engineering, Information Technology, Control Systems*, 24, 91-104.
- Romanova, O.A., Korovin, G.B., & Kuzmin, E.A. (2017). Analysis of the Development Prospects for the High-Tech Sector of the Economy in the Context of New Industrialization. *Revista Espacios*, 38(59), 25.
- Shilova, A.A. (2014). Economic Dynamics: Research Methodology. *NAUKA-RASTUDENT.RU: Electronic Scientific Journal*, 3(03), 7-12. Retrieved March 19, 2019 from <http://nauka-rastudent.ru/3/1244>, <https://doi.org/10.1016/j.jedc.2019.03.001>
- Skhirtladze, A.G., Skryabin, V.A., & Zotov, E.V. (2015). Unification in the Design and Testing of Products of Engineering Production. *Repairs. Recovery. Modernization*, 1, 44-48.
- Sobolev, A.A., & Solovev, V.I. (2017). Life Cycle Management of Complex Systems in the Context of System Engineering. *Innovations to Life*, 2(21), 137-174.

Tikhonov, A.I., & Sazonov, A.A. (2018). Prospects for Using the Methods of Mathematical Modeling and Digital Design in Ensuring Product Life Cycle Management. *Management and Business Administration*, 3, 118-128.

Tretyakov, V.M. (2014). Evaluation of the Diversity of Components of Manufactured Products. *Standards and Quality*, 12, 34-36.

Vilenskiy, P.L., Livshits, V.N., & Smolyak, S.A. (2015). *Assessment of Investment Projects Efficiency. Theory and Practice*. Moscow: Poli Print Service. (p. 1300).

Vlasov, A.I., Echeistov, V.V., Krivoshein, A.I., Shakhnov, V.A., Filin, S.S., & Migalin, V.S. (2018). An Information System of Predictive Maintenance Analytical Support of Industrial Equipment. *Journal of Applied Engineering Science*, 16(4), 515-522. <http://doi.org/10.5937/jaes16-18405>

Vlasov, A.I., & Demin, A.A. (2017). Visual Methods of Formalization of Knowledge in the Conditions of the Synchronous Technologies of System Engineering. In *ACM International Conference Proceeding Series*. <http://doi.org/10.1145/3166094.3166098>

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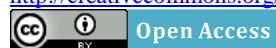
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## A MODEL FOR ESTIMATING SOCIAL AND ECONOMIC INDICATORS OF SUSTAINABLE DEVELOPMENT\*

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**Abstract.** There was developed a methodological approach for carrying out an integrated estimation of the sustainable development socio-economic parameters based on the UN's current information base. The article proposes a methodology and tools for economic and mathematical modelling to estimate the degree of international trade and investment relations development, the degree of life expectancy, the standard of living and prosperity of international entities under the influence of sources of economic growth. Based on the simulation results an analysis of the general status of the 189 world countries according to the sources of economic growth has been carried out. In order to obtain scientifically grounded results, the paper used general scientific and special methods of research, such as: methods of analysis and synthesis, system approach and abstraction, modelling (fuzzy logic model, a method of Saati hierarchies, Mamdani algorithm), quantitative and qualitative comparison methods, a method of theoretical generalization. The approach proposed in this article can be applied when developing the country's national economic development strategy in the direction of achieving sustainable development.

**Keywords:** fuzzy analysis; economic development; sustainable development; social fragmentation; economic growth; living standards and prosperity of international entities

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**JEL Classifications:** C61, F43 O11

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## 1. Introduction

The process of any country's development, specificity of implementing economic, social and political transformations in the context of global competition are always associated with a constructive economic development strategy that should be in line with the national interests and global trends in structural change.

Sustainable development is the current imperative of the economic system's structural rearrangement. Consequently, an increase of the world countries' competitiveness is correlated with the economic growth, modernization of the economy and society in accordance with the socio-economic indicators of sustainable development.

Under such conditions, modern theory and practice require elaborating new models of forecasting the economic systems' development, adapted to current realities. Taking into account contemporary integration processes, it is of particular significance to develop models that take into account the current state and prospects of applying factors and reserves to improve the international entities' efficiency in the direction of achieving sustainable development.

The following scholars research the problem of economic growth in the context of sustainable development Kaźmierczyk & Akulich 2018a, 2018b; Kvilinskyi *et al.* 2017; Kwilinski *et al.* 2019; Lakhno *et al.* 2018; Lankauskienė & Tvaronavičienė 2012; Luukkanen *et al.* 2019; Pająk *et al.* 2016; Raudeliūnienė *et al.* 2014; Solarin & Bello 2018; Tkachenko *et al.* 2019; Tvaronavičienė *et al.* 2014; Vosylius *et al.* 2013; Eddelani *et al.* 2019; Zeibote *et al.* 2019; Prakash, Garg 2019).

The scientific results obtained are not exhaustive due to the high dynamism and multivariate nature of the available research object. All of the above serve a prerequisite for further research and for setting the purpose of this article: to simulate the estimation of socio-economic parameters of international entities' sustainable development.

## 2. Literature review

At the initial stage, the ecological component dominated the approaches to determining the prerequisites for sustainable development: the Clean Development Mechanism (Karakosta *et al.* 2009; Edinger & Kaulb 2000), low carbon growth pathways (Blohmke 2014; Figueroa & Ribeiro 2013; Karpenko *et al.* 2018; Mazurkiewicz & Lis 2015, 2018; Pająk *et al.* 2017; Razminienė, Tvaronavičienė 2018; Yang *et al.* 2018), etc. At present, sustainable development provides for a broad range of socio-economic issues along with environmental ones in their interconnection and interaction: relationships between the natural environment and poverty (Schleicher *et al.* 2018), human rights-based approaches to global challenges (Arts 2017), aligning the Sustainable Development Goals with existing governance arrangements, and integrating the economic, social and environmental dimension (Biermann *et al.* 2017).

Socio-economic background for sustainable development is determined by economic development and the fight against income inequality. Income inequality quickly grows into inequality of well-being, which negatively affects social mobility – the basis of society's structure. Inequality is a social characteristic of a certain social state of individuals, certain segments of the population, which reflects their civil status, political and legal rights, and their relation to the means of production and its results. Inequality has social and economic aspects. The social aspect determines the people's unequal access to social rights and freedoms (the right to employment, health care,

medical care, etc.), while economic aspect is associated with the process of income distribution, inequality of opportunities, and discrimination. According to K. A. Nordström and J. Ridderstrale, polarization in the modern society is increasing, and new types of inequalities arise: value, education, information ones, etc. (Nordstrom & Ridderstrale 2000). Under these conditions, the asymmetry of the world countries' development is growing, which increases the gaps among the living standards of different segments of the population.

Social tension reveals the deepest level of human values and expresses people's true sense of life orientation. From the existential standpoint, sense-of-life values are formed basing on recognition of the objectively rational meaninglessness of existence, which forces an individual to construct his own value system by choosing and taking responsibility for this choice to oneself. Existential level of the value system in this case forms the human resource component of the economic development.

Access to education characterizes the social aspect of the economic development. Together with material wealth, knowledge belongs to the list of scarce resources, the volume of which determines the integral position of an individual in the social space, associated with a specific set of life opportunities. Qualitative education, namely, the new knowledge and ability to use them to form human capital is a momentum of the economic development.

The informational type of fragmentation determines the information environment and the ability to adapt to it. One of the current characteristics of the informational type of fragmentation is the number of the Internet users. The number of Internet users as on July 30, 2018 amounted to 4,208,571,287 people out of the total world population of 7,634,457,932 people (Internet World Stats 2018). According to the research by RetailMeNot Inc., the world's largest producer of digital coupons on the commodity market, the scope of the Internet trade has grown significantly in recent years. The share of Internet commerce accounts for 6.5% of total retail sales in the world (Centre for Retail Research 2018). It should be borne in mind that the real value of this indicator is higher than 6.5%. This is due to the large number of small online stores, whose activities are virtually impossible to be taken into account. The Internet opens the door to the labour market, which is actively developing in the virtual space. Only Quintessential Careers, the most authoritative and comprehensive career development site according to Forbes, offers over 50 job placement portals. The Internet is an environment for knowledge sharing and access to it. Free access to scientific information leads to an increase in the rate of scientific and technical progress. Given the aforementioned, the number of the country's Internet users should be considered as one of the sources for the economic growth.

It should be noted that the world system's transition towards sustainable development depends on the real socio-economic opportunities for each country's development. Ensuring the balance of the socio-economic system means overcoming the income inequality and the effective use of the resources promoting the economic development in the interests of the population. Consequently, the socio-economic dimension of sustainable development implies an increase in the quality of life and well-being of the international entities under the influence of sources for economic growth.

### **3. Methodology**

This article develops and analyses a set of fuzzy logic models, which determine the index of living standards and prosperity of the international entities under the influence of sources of economic growth. The index of living standards and prosperity of the international entities under the influence of sources of economic growth is determined by the indicators applied by the Human Development Report Office (HDRO) at the United Nations Development Programme (UNDP) in calculating the Human Development Index (HDI). These calculations are based on the statistical values for 189 countries with the most recent data for 2017. Of these countries, 59 are in

the very high human development group, 53 in the high, 39 in the medium and only 38 in the low (Human Development Report 2018).

A set of models consists of:

1. Model A, a fuzzy logic model for determining the degree of international trade and investment relations development, which forms the component of international trade relations in the general structure of the models set.

2. Model B, a fuzzy logic model determining the degree of life expectancy and the extreme stress component of life, which leads a person to decide on its termination (suicide). The model forms the human resource component in the overall structure of the models set.

3. The Unit for calculating the education index EI, which forms the component of the education duration and availability in the overall structure of the models set.

4. Model C, a fuzzy logic model for determining the index of living standards and prosperity of the international entities under the influence of sources of economic growth. Model C uses the calculations results of model A, model B, a calculation unit for the education index EI and the following indicators:

- EPR - employment to population ratio;
- IU - Internet users;
- RDE - Research and development expenses.

### 3.1. Model A

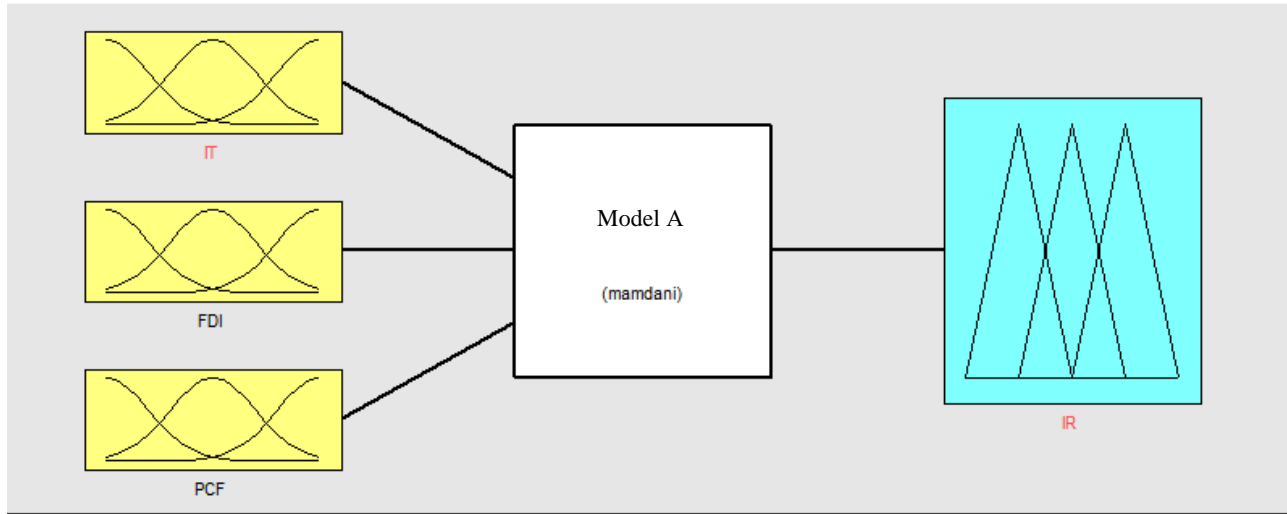
The fuzzy logic model for determining the degree of international trade and investment relations development (model A) contains three fuzzy input variables and one output. The value of the resulting variable IR (international rate) reflects the degree of international trade and investment relations development for each of the countries. The value of this indicator is within the range from 0 to 1. The indicator is a dimensionless quantity. The IR calculation is based on the statistical values of the indicators given in Table 1.

**Table 1.** The calculated basis for the variable IR model of the degree of international trade and investment relations development

Parameter name	Parameter definition, according to the UN terminology database
<b>International trade (IT)</b>	A basic indicator of openness to foreign trade and economic integration. It indicates the dependence of domestic producers on foreign demand (exports) and of domestic consumers and producers on foreign supply (imports), relative to the country's economic size (GDP). Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
<b>Foreign direct investment, net inflows (FDI)</b>	Sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital, expressed as a percentage of GDP.
<b>Private capital flows (PCF)</b>	Net foreign direct investment and portfolio investment, expressed as a percentage of GDP.

*Source:* own processing according to data of the Human Development Report (2018)

The structure of the fuzzy logic model is shown in Figure 1.



**Fig.1.** The structure of the fuzzy logic model that reflects the international trade component

Source: authors' research

The structure of the model shown in Figure 1 corresponds to the structure of the fuzzy logical conclusion (Terano *et al.* 1994). In blocks of IT, FDI, PCF there are phasification processes, that is, the conversion of clear values of variable inputs into a fuzzy form by determining a degree of the input value belonging to its terms. The result of the IR block calculation is subject to de-phasification:

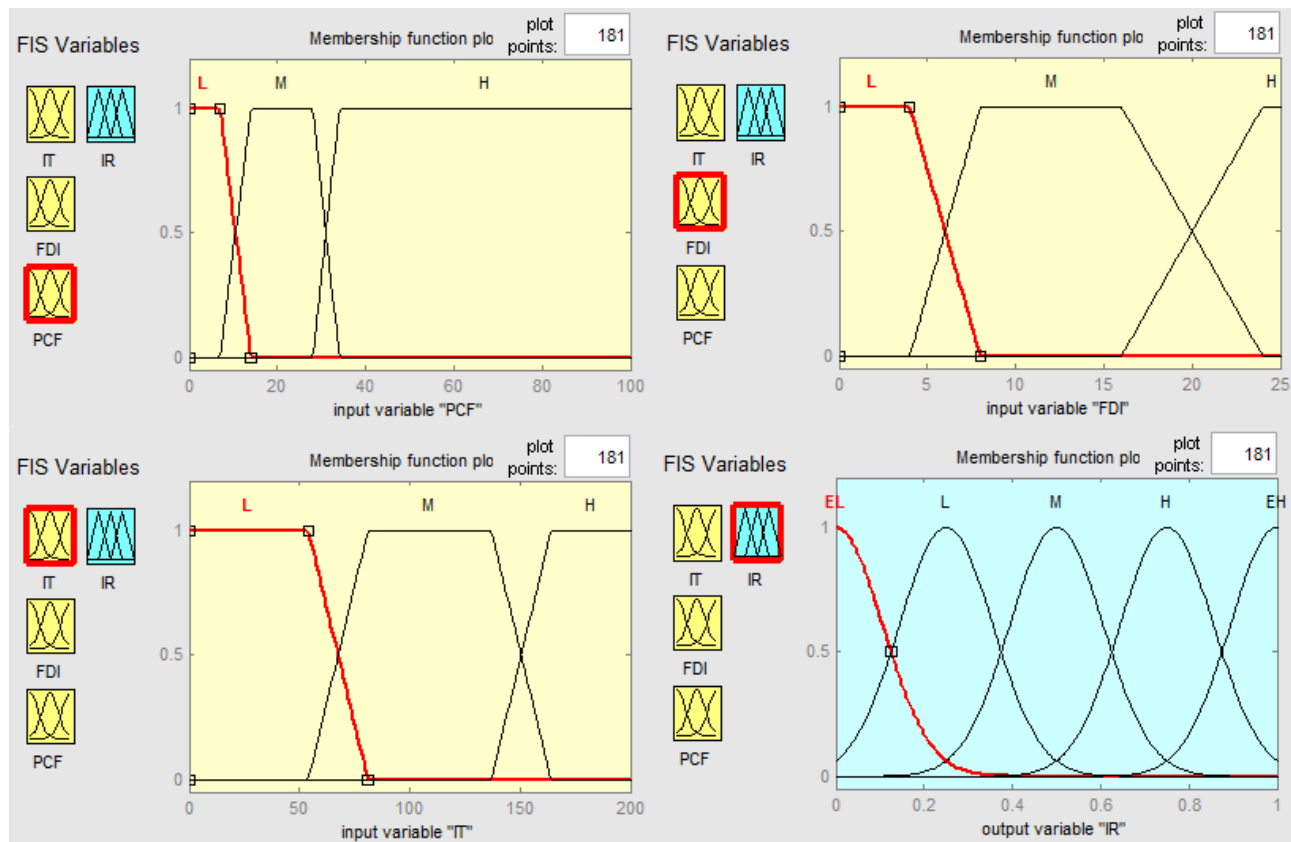
The rules of the Mamdani fuzzy knowledge base are compiled taking into account the hierarchy of the priorities of the input variables established by MAI Saaty (the Saaty method of hierarchies' analysis) for an agreed matrix of pairwise comparisons (Mamdani 1974; Saaty 2001). Knowledge base rules determine the dependence of IR on IT, FDI, PCF in case the ratios of the specified characteristics are different: extra low - EL; low - L; medium - M; high - H); extra high - EH. Knowledge base rules are as follows:

1. If (IT is L) and (FDI is L) and (PCF is L) then (IR is EL)
2. If (IT is L) and (FDI is L) and (PCF is M) then (IR is EL)
3. If (IT is L) and (FDI is L) and (PCF is H) then (IR is EL)
4. If (IT is L) and (FDI is M) and (PCF is M) then (IR is EL)
5. If (IT is L) and (FDI is H) and (PCF is M) then (IR is L)
6. If (IT is L) and (FDI is M) and (PCF is H) then (IR is L)
7. If (IT is L) and (FDI is H) and (PCF is H) then (IR is L)
8. If (IT is M) and (FDI is L) and (PCF is L) then (IR is L)
9. If (IT is M) and (FDI is L) and (PCF is M) then (IR is M)
10. If (IT is M) and (FDI is L) and (PCF is H) then (IR is M)
11. If (IT is M) and (FDI is M) and (PCF is M) then (IR is M)
12. If (IT is M) and (FDI is H) and (PCF is M) then (IR is M)
13. If (IT is M) and (FDI is M) and (PCF is H) then (IR is M)
14. If (IT is M) and (FDI is H) and (PCF is H) then (IR is H)
15. If (IT is H) and (FDI is L) and (PCF is L) then (IR is H)
16. If (IT is H) and (FDI is L) and (PCF is M) then (IR is H)
17. If (IT is H) and (FDI is L) and (PCF is H) then (IR is EH)
18. If (IT is H) and (FDI is M) and (PCF is M) then (IR is EH)
19. If (IT is H) and (FDI is H) and (PCF is M) then (IR is EH)
20. If (IT is H) and (FDI is M) and (PCF is H) then (IR is EH)

21. If (IT is H) and (FDI is H) and (PCF is H) then (IR is EH)
22. If (IT is H) and (FDI is H) and (PCF is L) then (IR is EH)
23. If (IT is L) and (FDI is M) and (PCF is L) then (IR is EH)
24. If (IT is L) and (FDI is H) and (PCF is L) then (IR is EH)
25. If (IT is M) and (FDI is M) and (PCF is L) then (IR is M)
26. If (IT is M) and (FDI is H) and (PCF is L) then (IR is M)
27. If (IT is H) and (FDI is M) and (PCF is L) then (IR is H)

It is necessary that the knowledge base is compact, that is, it contains close to the minimum number of rules necessary for an adequate modelling of the studied dependence. With a large number of input variables, the compactness of the knowledge base provides a hierarchical representation of the rules (Rotshtein 1998; Miller 1956).

Terms of a fuzzy logic model are shown in Figure 2.

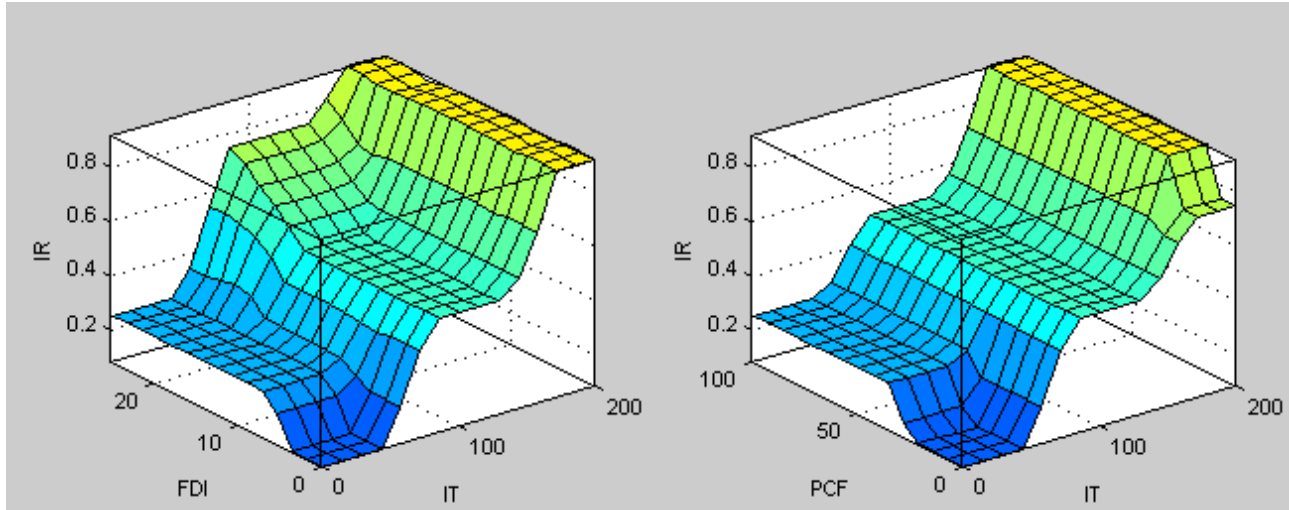


**Fig. 2.** Graphic representation of the terms of the model, reflecting the degree of international trade and investment relations development

Source: authors' research

Figure 2 shows the terms of the model variables. The boundaries of the input variables terms are determined on the basis of statistical analysis of the data for each of the variables.

The graphs of the surfaces reflecting the dependence of the output values on the input values are shown in Figure 3.



**Fig. 3.** The graphic representation of surfaces that shows the dependence of the variable IR on variables FDI, IT and PCF

*Source:* authors' research

The surface graphs shown in Figure 3 illustrate the existence of nonlinear dependencies between the input variables and the output variable in the model.

### 3.2. Model B

The fuzzy logic model evaluating the life-cycle (model B) contains two fuzzy inputs and one output. The value of the resulting variable SF (stability fraction) reflects the degree of life expectancy. The value of this indicator is within the range from 0 to 1. The indicator is a dimensionless quantity. The calculation of SF is based on the statistical values of the indicators given in Table 2.

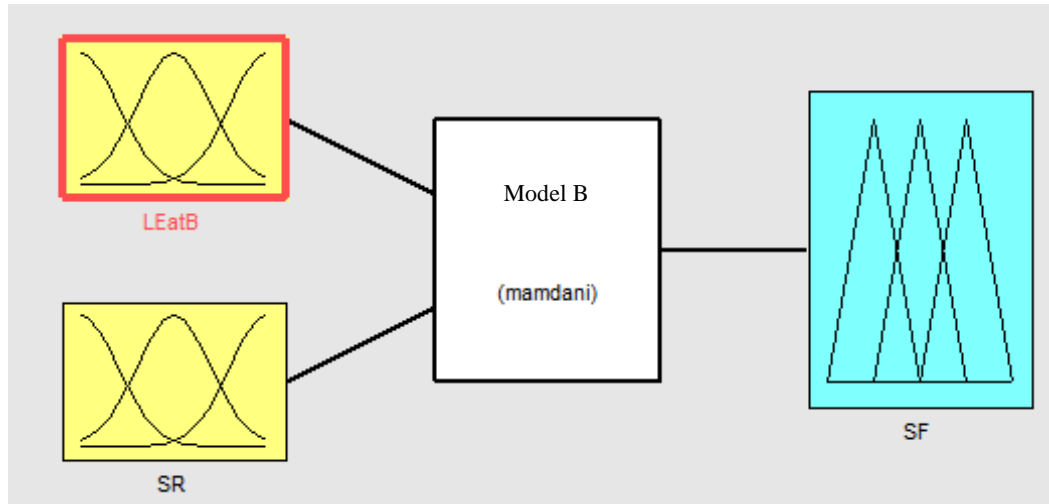
**Table 2.** The estimated base of the model's SF variable estimating the life expectancy in the country

Parameter name	Parameter definition, according to the UN terminology database
<b>Life expectancy at birth (LEatB)</b>	Number of years a new-born infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth stay the same throughout the infant's life.
<b>Suicide rate (SR)</b>	Number of deaths from purposely self-inflicted injuries, in the total population or of a given sex or age, divided by the total number of the reference population, expressed per 100,000 people.

*Source:* own processing according to data of the Human Development Report (2018)

The structure of the fuzzy logic model is presented in Figure 4.





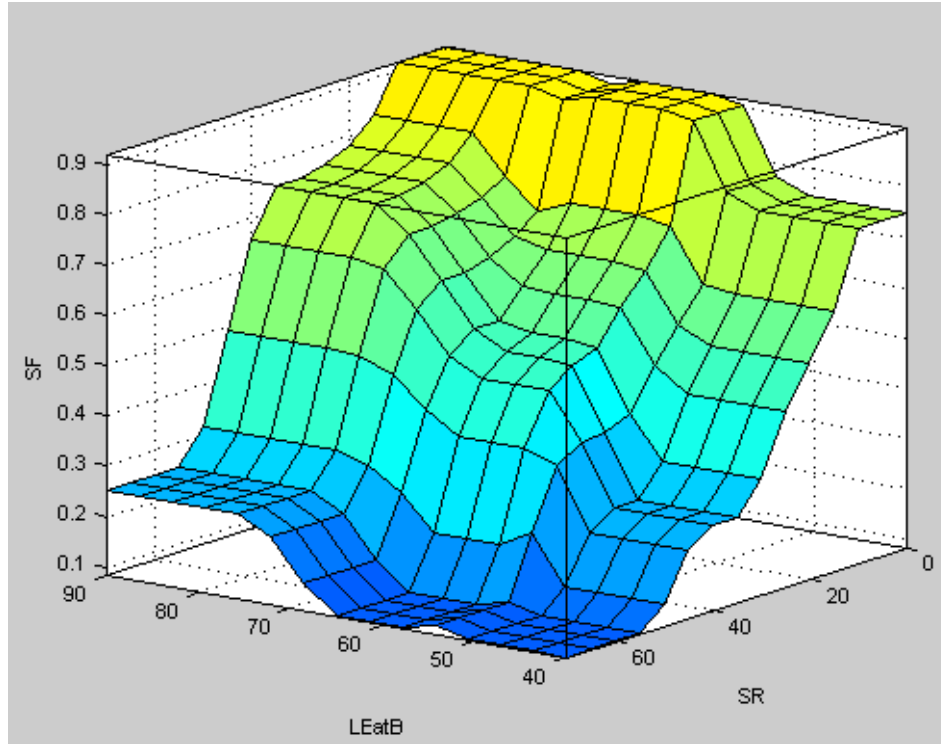
**Fig. 4.** The structure of a fuzzy logic model that reflects the component of the life duration and marginal stress component in the country  
*Source:* authors' research

The structure of the model shown in Figure 4 corresponds to the structure of the fuzzy logic conclusion and involves transformation of the output quantity into a number (the dephasing process) (Terano *et al.* 1994).

The rules of the Mamdani fuzzy knowledge base are compiled taking into account the hierarchy of priorities of the input variables, established by MAI Saaty according to an agreed matrix of pairwise comparisons. The rules of the knowledge base determine the dependence of SF on LEatB and SR provided the ratios of these characteristics state are different: EL, L, M, H, EH. Knowledge base rules are as follows:

1. If (LEatB is L) and (SR is L) then (SF is H)
2. If (LEatB is L) and (SR is M) then (SF is L)
3. If (LEatB is L) and (SR is H) then (SF is EL)
4. If (LEatB is M) and (SR is L) then (SF is EH)
5. If (LEatB is M) and (SR is M) then (SF is M)
6. If (LEatB is M) and (SR is H) then (SF is EL)
7. If (LEatB is H) and (SR is L) then (SF is EH)
8. If (LEatB is H) and (SR is M) then (SF is H)
9. If (LEatB is H) and (SR is H) then (SF is L)

It should be noted that the expected life expectancy at birth (variable LEatB) and the suicide ratio (variable SR) have a different directional effect on the resulting variable SF, which characterizes the life expectancy of the country. There is an inverse proportional relationship between SF and SR. A surface graph describing the output value (SF) dependence on input values (LEatB and SR) is presented in Figure 5.



**Fig. 5.** The graphical representation of the surface, showing the dependence of the SF variable on the variables LEatB and SR  
*Source:* authors' research

The surface graph shown in Figure 5 indicates a nonlinear relationship between the input variables and the output variable in the model.

### 3.3. Education index

The calculation of the education index (EI) is based on the statistical values of the indicators given in Table 3.

**Table 3.** The calculation basis for the index of education EI

Parameter name	Parameter definition, according to the UN terminology database
Mean years of schooling (MYS)	Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level.
Expected years of schooling (EYS)	Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life.

*Source:* own processing according to data of the Human Development Report (2018)

Education index EI is calculated by the formula (1):

$$EI = \left( \frac{MYS_i - MYS_{\min}}{MYS_{\max} - MYS_{\min}} + \frac{EYS_i - EYS_{\min}}{EYS_{\max} - EYS_{\min}} \right) / 2 \quad (1)$$

where  $MYS_i$  – the average number of years of training for the  $i$ -th country;

$EYS_i$  – expected duration of training for the  $i$ -th country;

$MYS_{\max}$  – the maximum number of years of study among countries according to 2017 data;

$EYS_{\max}$  – the maximum expected duration of education in countries according to 2017 data;

$MYS_{\min}$  – the minimum number of years of study among countries according to 2017 data;

$EYS_{\min}$  – the minimum expected duration of education in the world countries according to 2017 data.

The above formula is used by the UN to calculate this index and is given in the technical documentation accompanying the Human Development Report (2018). It also explains the choice of maximum and minimum values, according to the UN experts.

### 3.4. Model C

The fuzzy logic model determining the index of living standard and prosperity of the international entities under the influence of the sources of the economic growth (model C) is a model of the top level of hierarchy. It includes the first two models and the results of calculations of the education index EI. It also comprises three more independent variables shown in Table 4.

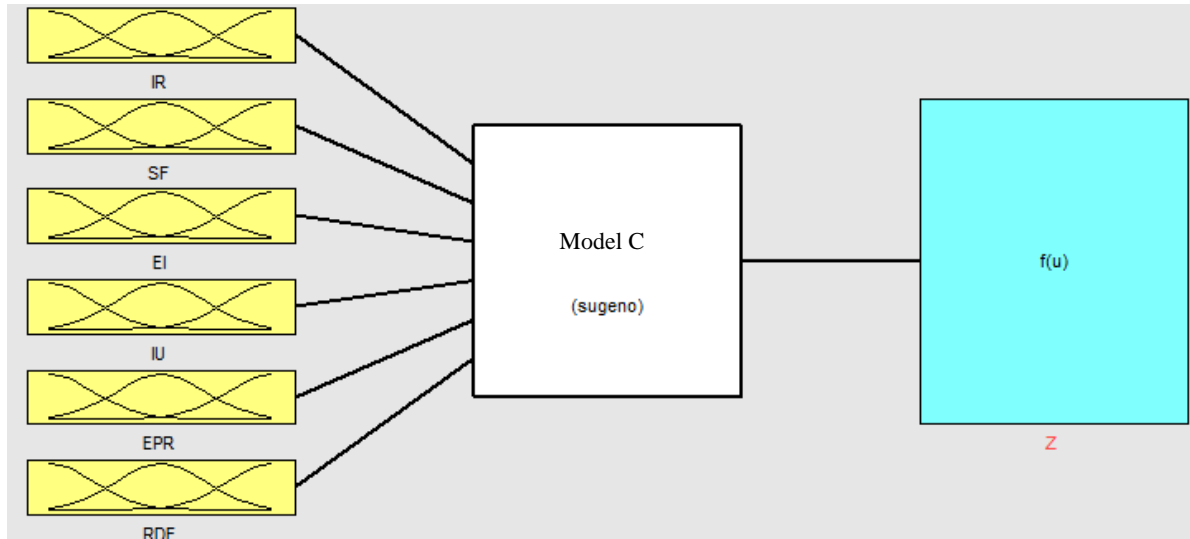
**Table 4.** The calculation base of the model determining the influence of sources of economic growth on the index of living standards and prosperity of the international entities.

Parameter name	Parameter definition, according to the UN terminology database
<b>Employment to population ratio (EPR)</b>	Percentage of the population ages 15 and older that is employed.
<b>Internet users (IU)</b>	Percentage of people with access to the worldwide network
<b>Research and development expenditure (RDE)</b>	Current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge and the use of knowledge for new applications, expressed as a percentage of GDP. It covers basic research, applied research, and experimental development.
<b>Gross national income (GNI) per capita</b>	Aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollars using PPP rates, divided by midyear population.

Source: own processing according to data of the Human Development Report (2018)

Figure 6 presents the overall structure of the final model for determining the index of living standards and prosperity of the international entities under the influence of sources of economic growth.

The structure of the model shown in Figure 6 corresponds to the hierarchical system of fuzzy logical conclusion. The system presented allows establishing multifactorial dependence, using the results of the logical conclusion from the fuzzy knowledge bases of previous levels, namely results of model A and model B.



**Fig. 6.** The structure of the model for determining the index of living standards and prosperity of the international entities under the influence of sources of economic growth  
Source: authors' research

In order for the result of the model (variable Z) to be of dimensionless quantity and to show the degree of the country's GNI in comparison with the best values among the countries of the world, but not its absolute dimension, all GNI values should be normalized:

$$GNI_i^n = \frac{GNI_i}{GNI_{\max}} \quad (2)$$

where  $GNI^n$  – the normalized value of per capita GNI for the  $i$ -th country;

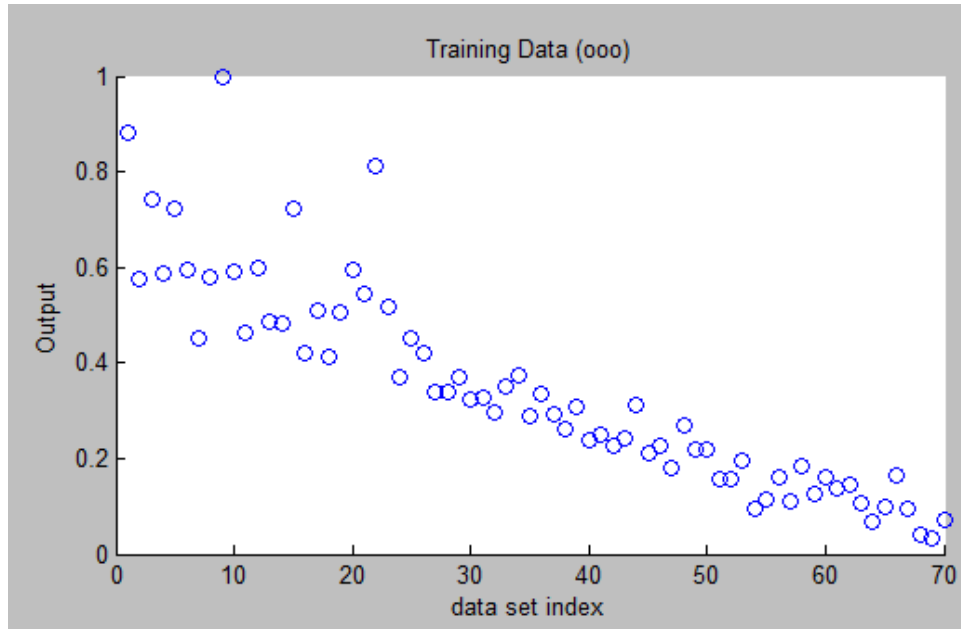
$GNI_i$  - the value of per capita GNI for the  $i$ -th country;

$GNI_{\max}$  - maximum per capita GNI per a country according to 2017 data.

Figure 7 presents the initial multidimensional array of 70 elements to train the model to determine the index of living standards and prosperity of the international entities under the influence of sources of the economic growth.

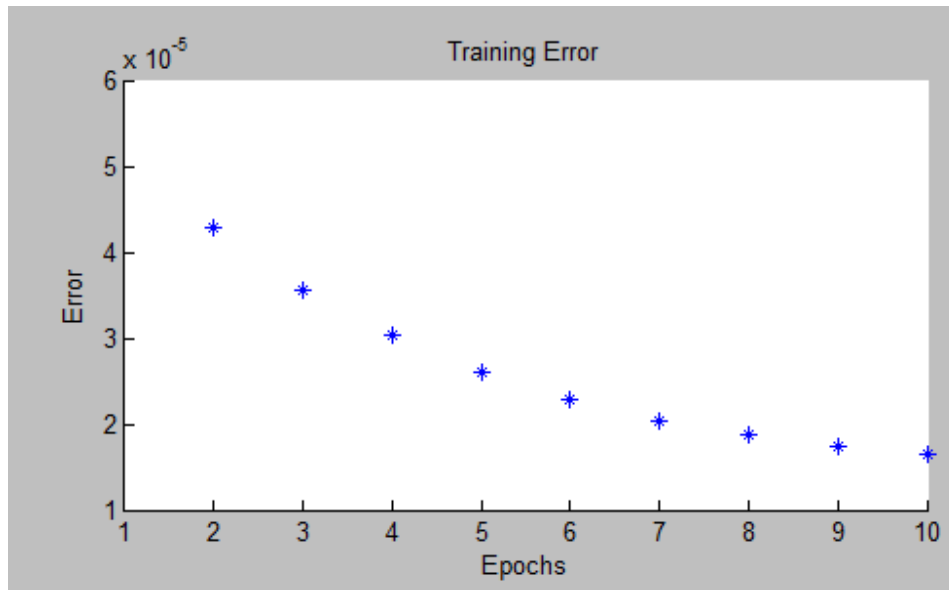
The abscissa axis in Figure 7 shows the numbers of the ordered elements of a multidimensional array, which includes the following parameters of the model: IR, SF, EI, EPR, IU, RDE. The values of the original variable Z are within the range from 0 to 1.

The fuzzy model training was carried out using the method of subtractive clusterization (Höppner *et al.* 1999). This method is used in the case when it is impossible to determine in advance the number of clusters. The algorithm is informed by the ideas of the mountain clustering, which was proposed by Ronald Yager and Dimitar Filev. The specific feature of the method is no necessity to set the number of clusters before starting an algorithm (Shtovba 2007; Karakose & Akin 2010). In the first step of mountain clustering, there are defined points which can be the centres of clusters. In the second step, for each such point, the potential value is calculated, which shows the possibility of forming a cluster in its outskirts. The more densely are the objects located in the outskirts of the cluster's potential centre, the higher is the value of its potential. After this, the centres of clusters are iterated among the points with maximum potentials.



**Fig. 7.** Initial data  
Source: authors' research

The graph of training errors is presented in Figure 8.



**Fig. 8.** The error dynamics in the model training process  
Source: authors' research

The data presented in Figure 8 indicate that in the model training process the model's error dropped from 0.00006 to 0.00002.

Using statistics of a multidimensional array, threshold values are automatically corrected to minimize the model error. In essence, this process represents the fitting of the model, implemented by the algorithms applied, to the existing training data. An error for a model's specific configuration is determined by an iterative run through a model of all available observations and a comparison of the output values calculated using a model with desired (target) values. All such differences are summed up in the so-called error function, the value of which is the model's error (Kendall & Stuart 1979; Bishop 1996).

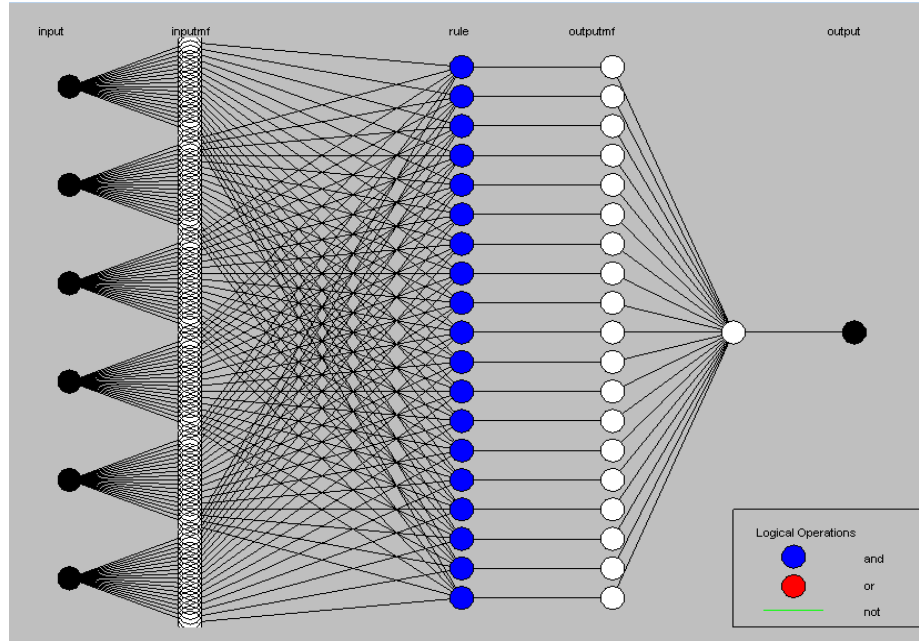
The verification of the synthesized fuzzy logic model efficiency in determining the index of living standards and prosperity of the international entities under the influence of sources of the economic growth (model C) according to the output data is summarised in Figure 9.

The results of the model C testing after its training, presented in Figure 9, indicate that the calculated values of the resulting indicator obtained with the help of the model coincide with its actual values.



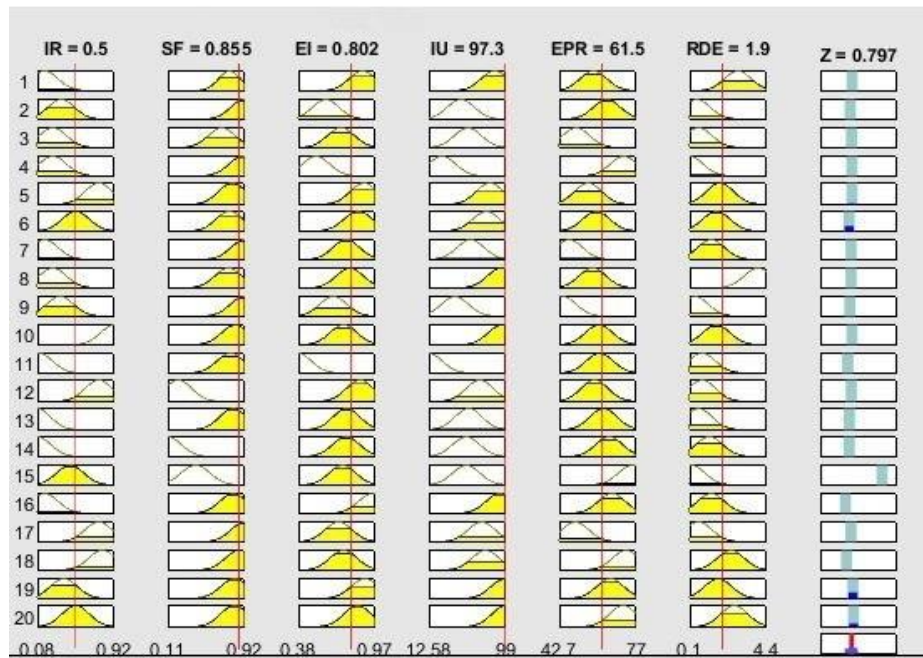
**Fig. 9.** Results of the model C testing after its training  
Source: authors' research

Figure 10 shows the internal logic of the top-level model C, the input of which has 6 variables, and the base of fuzzy knowledge contains 20 rules.



**Fig. 10.** The internal logic of a model defining the index of living standards and prosperity of the international entities under the influence of sources of the economic growth  
*Source:* authors' research

Figure 11 depicts a graphical representation of the model C system of rules on the example of Norway.



**Fig. 11.** Calculation of the total index of living standards and prosperity Z according to Norway's statistical data  
*Source:* authors' research



Figure 11 shows calculation of the total living standard and prosperity index Z based on Norwegian statistics, which ranks first in terms of HDI according to the UN data as of 2017.

#### 4. Results and discussions

The analysis of modelling results suggests that foreign trade is a source of the economic growth, but its large volumes are not an obligatory component in forming a high level of gross national income per capita. This is evidenced by the figures given in Table 5. Countries shown in Table 5 ranked by 2017 Human Development Index (HDI) value.

**Table 5.** Relationship between the level of living standards and prosperity of the international entities with the level of international trade and investment relations development

HDI rank	Country	Index of international trade and investment relations development IR	Index of living standards and prosperity of the international entities Z
1	Norway	0.50	0.797
5	Germany	0.28	0.540
7	Sweden	0.35	0.559
10	Netherlands	0.79	0.561
14	United Kingdom	0.50	0.458
20	Austria	0.25	0.532
33	Poland	0.50	0.306
36	Lithuania	0.65	0.332
71	Georgia	0.50	0.108
88	Ukraine	0.25	0.095
...	...	...	...

*Source:* compiled by the authors based on authors' research and data of the Human Development Report (2018)

The results of calculations summarised in Table 5 indicate that there are countries in which the level of international trade and investment relations development is significantly lower than the average level of this indicator among other countries of the world, but this does not prevent them from achieving a high level of gross national income per capita. Among such countries are Norway, the US, Germany, Japan. Index Z values for these countries are high because of high standards of living and substantial research and development expenses. This is evidenced by the value of the predicted life expectancy at the birth of the  $LEB \geq 80$  years and the value  $RDE \approx 3\%$ .

In the context of international trade and investment relations development, Ukraine has indicators close to the average in comparison with other countries, but due to low values of other parameters of the model ( $LEB = 72.1$  years,  $EPR = 49.1\%$ ,  $IU = 52.5\%$ ,  $RDE = 0.6\%$ ), its index of living standards and prosperity of the international entities is very low and accounts for only 0.095. By the level of this indicator's value, Ukraine takes the 111th place among other countries of the world. The countries neighbouring Ukraine in terms of Z indicator are Jordan, Namibia, Indonesia, Mongolia, Jamaica, Armenia, Paraguay, Guatemala, Jamaica.

Under these conditions, potential sources of the economic growth in Ukraine may include:

- research and development expenses RDE, because for countries with high levels of living standards and prosperity, the RDE value is on average 2.5% of GDP;
- the Internet users' distribution IU, because for developed countries the value of IU is not less than 70% of the total population of the country.

This is evidenced by the predicted value of Z indicator, which was obtained by simulation results.

After all, the increase of the RDE from 0.6% to 2.5%, which is standard for many developed countries such as France, Austria, Germany, Singapore, Canada, and Australia, will ensure a three-times increase of the Z index ( $Z = 0.285$ ). The countries closest to the Z indicator's value = 0.285 are Malaysia, Hungary, Latvia, and Greece.

An increase in the IU indicator from 52.5% to 62.5% will result in 2.3 times increase of Z ( $Z = 0.21$ ). For 53 countries of the world, such as Norway, Denmark, Great Britain, Canada, Germany, France, USA, Japan, Hungary and others IU values are no less than 70%.

An analysis of the general status of international entities by sources of the economic growth is summarised in Table 6.

**Table 6.** An analysis of the international entities

Index	The indicator's average value among the countries of the world	Percentage of countries in which the indicator's value is less than the average or the statistical data are missing, %
Index of Development of International Trade and Investment Relationships, IR	0.32	60.0
Lifecycle index, SF	0.78	55.2
Education index, EI	0.58	45.2
Internet users, IU	45.7%	44.6
Employment population ratio, ERP	58.6%	47.1
Research and development expenses, expressed as a percentage of GDP, RDE	2%	85.6

*Source:* compiled by the authors based on authors' research and data of the Human Development Report (2018)

The results of the calculation shown in this table indicate that, for the indicators RDE, IR, SF, more than half of the world's countries are lower than the average. The worst results are observed in RDE, with only 14.4% of countries having research and development expenses of more than 2% of the country's GDP.

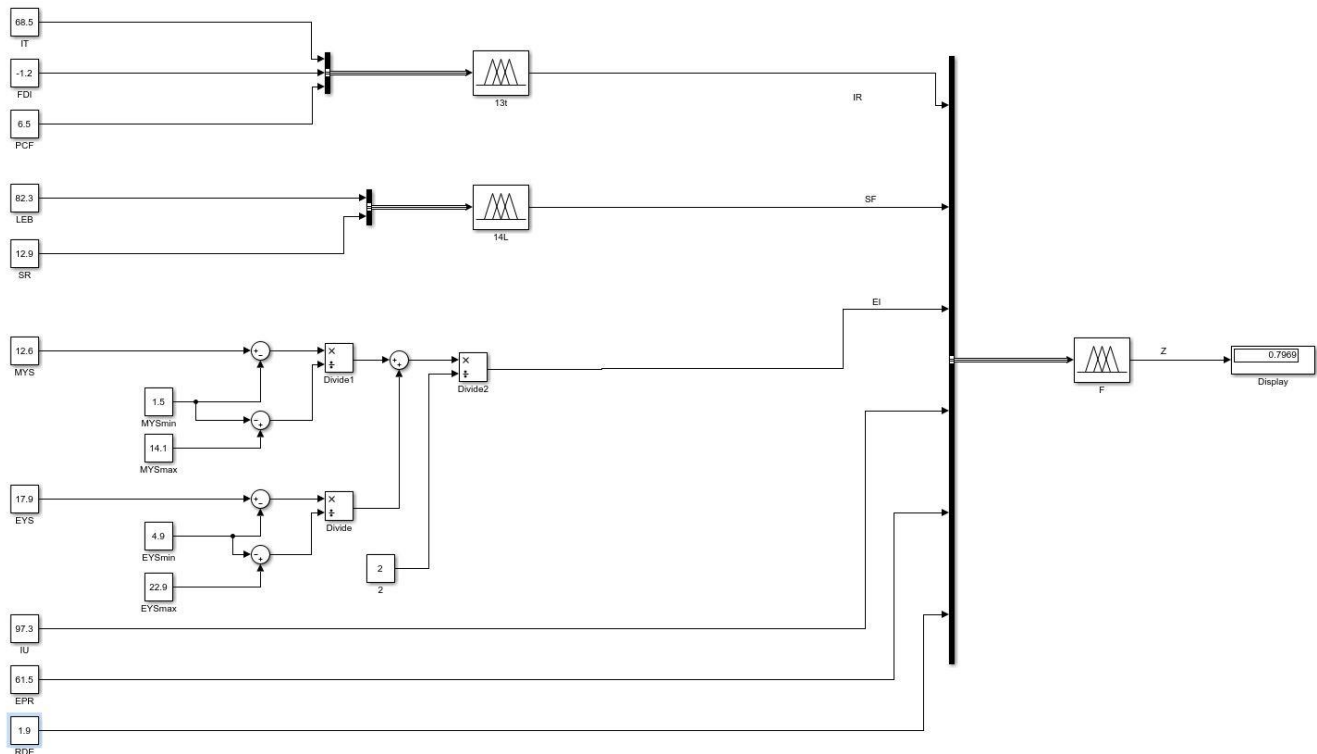
Thus, it can be concluded that the greatest potential to influence the countries' economic development is seen in the process of increasing expenditures (both public and private) for research aimed at raising the level of knowledge systematically and at transforming knowledge into new technologies (RDE factor). The optimal level of RDE is 2.5 - 3% of the country's GDP, as evidenced by the world experience. The second place among the sources of economic development is taken by international trade and investment relations development (IR) and the improvement of social and economic conditions for living in the country (SF). The third place among the sources of the economic development by their potential belongs to the distribution of the global Internet and the creation of easy-access conditions for the Internet users (IU) and addressing employment problems (EPR). As for the level of education (EI), its low level is now a characteristic feature of Africa, not of the world as a whole.

It should be borne in mind that there are no data on the majority of indicators presented in the UN reports for the vast majority of countries (Cambodia, Congo, Zambia, Nepal, Pakistan, Angola, Zimbabwe, Nigeria, Senegal, Uganda, Afghanistan, Mali, Mozambique and others) in the so-called Low Human Development group. Thus, the lack of data in these countries leads to distortion of the model results at some intervals in the field of determining the input parameters. For the models developed, these are low values intervals of independent variables. The UN researchers use approximation methods, which also distorts the calculations results of the HDI indicator's final value.

In a number of countries, there are atypical combinations of values used in the model. These are countries whose economies are entirely or largely dependent on the oil or gas trade, such as Qatar, Iran, Iraq, Kuwait, Saudi Arabia, Russia, the People's Republic of China. For the developed set of models, they are the so-called statistical noise. This, in turn, increases the error in the calculations obtained on the basis of the model.

Having excluded from the information matrix the lines with incomplete data, the model C final training was informed by 70 observations, which covered all groups of countries as much as possible. The training resulted in cluster groups and 20 rules. Model C gives precise results when input data fall within the range of the clusters found. This is evidenced by the fact that in the training process the model's error has dropped from 0.00006 to 0.00002. But, due to the problem of incomplete initial data in the model, there are "blind" zones (intervals). In case input parameters fall within these intervals, the result of the model calculation can differ considerably from the actual one. It should be noted that the above problem is typical only of model C. It is absent in models A and B, since they are Mamdani type models, and the fuzzy knowledge base (model rules) is composed using MAI Saaty and the economic logic.

The developed set of models was realized in Simulink, which is one of the MATLAB computing modules. Figure 12 presents the models set implementation in Simulink environment on the example of calculating the Z indicator according to Norway's data.



**Fig. 12.** Implementation of a models set in Simulink  
Source: authors' research

In Figure 12, the value of the indicator  $Z = 0.797$  indicates that this combination of input parameters values (sources of the economic growth) allows generating a high level of gross national income (GNI) per capita (the

value is close to one) in Norway. Modest use of the income obtained will further increase the potential of the state in order to:

- improve the health care system, health insurance, and implement programs aimed at protecting the environment;
- fund research programs;
- improve the education system to meet the current and future needs;
- provide free access to information;
- solve the problems of employment for the population;
- develop international trade relations.

## 5. Conclusions

The developed set of fuzzy logic models that defines the index of living standards and prosperity of international entities under the influence of sources of the economic growth provides an opportunity to estimate the expected level of gross national income per capita at different combinations of values of independent variables. The result obtained can be used in elaborating the programs of national economies' strategic development in the direction of achieving sustainability.

The software implementation of this set of models provides an opportunity of its automated application to do real-time calculations, which allows performing the function of monitoring the indicators used in the models. Each of the developed models can be used independently or be involved in another set of models depending on the research objectives. That is, each model is a functional, independent unit.

Further studies aimed at developing a comprehensive methodology for quantitative estimation and analysis of the balance level of social and economic system at the national and world levels proves to be a promising area of the research.

## References

- Arts, K. 2017. Inclusive sustainable development: a human rights perspective, *Current Opinion in Environmental Sustainability* 24: 58-62. <https://doi.org/10.1016/j.cosust.2017.02.001>
- Biermann, F.; Kanie, N.; Kim R.E. 2017. Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals, *Current Opinion in Environmental Sustainability* 26-27: 26-31. <https://doi.org/10.1016/j.cosust.2017.01.010>
- Bishop, C. 1996. *Neural Networks for Pattern Recognition*. Oxford: Published by Oxford University Press.
- Blohmke, J. 2014. Technology complexity, technology transfer mechanisms and sustainable development, *Energy for Sustainable Development* 23: 237-246. <https://doi.org/10.1016/j.esd.2014.09.003>
- Centre for Retail Research 2018. Retrieved from <http://www.retailresearch.org/onlineretailing.php>
- Eddelani, O.; El Idrissi, N. E.; Monni, S. 2019. Territorialized forms of production in Morocco: provisional assessment for an own model in gestation, *Insights into Regional Development* 1(1): 6-18. [https://doi.org/10.9770/ird.2019.1.1\(1\)](https://doi.org/10.9770/ird.2019.1.1(1))
- Edingera, R; Kaulb, S. 2000. Humankind's detour toward sustainability: past, present, and future of renewable energies and electric power generation, *Renewable and Sustainable Energy Reviews* 4(3): 295-313. [https://doi.org/10.1016/S1364-0321\(99\)00017-9](https://doi.org/10.1016/S1364-0321(99)00017-9)
- Entrepreneurship: Investment and Innovation): 1528-2651-22-S1-337: 1-7.

- Figuerola, M. J.; Ribeiro, S. K. 2013. Energy for road passenger transport and sustainable development: assessing policies and goals interactions, *Current Opinion in Environmental Sustainability* 5(2): 152-162. <https://doi.org/10.1016/j.cosust.2013.04.004>
- Höppner, F. Klawonn, F.; Kruse, R.; Runkler, T. 1999. *Fuzzy cluster analysis: methods for classification, data analysis and image recognition*. New York: Published by John Wiley & Sons.
- Human Development Report 2018. Retrieved from [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)
- Internet World Stats 2018. Retrieved from <http://www.internetworldstats.com/>
- Karakose, M.; Akin, E. 2010. Block Based Fuzzy Controllers, *International Journal of Research and Reviews in Applied Sciences* 3(1): 100 – 110. Retrieved from [https://www.arpapress.com/Volumes/Vol3Issue1/IJRRAS\\_3\\_1\\_11.pdf](https://www.arpapress.com/Volumes/Vol3Issue1/IJRRAS_3_1_11.pdf)
- Karakosta, C.; Doukas, Y.; Psarras, J. 2009. Directing clean development mechanism towards developing countries' sustainable development priorities, *Energy for Sustainable Development* 13(2): 77-84. <https://doi.org/10.1016/j.esd.2009.04.001>
- Karpenko, L.; Serbov, M.; Kwilinski, A.; Makedon, V.; Drobyazko, S. 2018. Methodological platform of the control mechanism with the energy saving technologies, *Academy of Strategic Management Journal* 17(5): 1939-6104-17-5-271: 1-7. Retrieved from <https://www.abacademies.org/articles/Methodological-platform-of-the-control-mechanism-1939-6104-17-5-271.pdf>
- Kaźmierczyk, J.; Akulich, M. 2018a. The socio-economic approach to the study of main economic systems. Socialism and capitalism. Part 1, *Management* 22(1): 238-250. <https://doi.org/10.2478/manment-2018-0017>
- Kaźmierczyk, J.; Akulich, M. 2018b. The socio-economic approach to the study of modern economic systems. Post-capitalism. Part 2, *Management* 22(2): 299-310. <https://doi.org/10.2478/manment-2018-0038>
- Kendall, M.; Stuart, A. 1979. *The advanced theory of statistics. Volume II: Inference and Relationship, 4th edition*. New York: Published by Macmillan.
- Kvilinskyi, O.; Mieshkov, A.; Bondaryeva, I. 2017. Investigation of the social factors of development of society in the territories with transforming environment, *Research Papers in Economics and Finance* 2(2), 13-19. <https://doi.org/10.18559/ref.2017.2.2>
- Kwilinski, A.; Dalevska, N.; Kravchenko, S.; Hroznyi, I.; Kovalenko, I. 2019. Formation of the entrepreneurship model of e-business in the context of the introduction of information and communication technologies, *Journal of Entrepreneurship Education* 22(Special Issue 1) <https://www.abacademies.org/articles/Formation-of-the-entrepreneurship-model-of-e-business-in-1528-2651-22-S1-337.pdf>
- Lakhno, V.; Malyukov, V.; Bochulia, T.; Hipters, Z.; Kwilinski, A.; Tomashevskaya, O. 2018. Model of managing of the procedure of mutual financial investing in information technologies and smart city systems, *International Journal of Civil Engineering and Technology* 9(8), 1802-1812. Retrieved from [http://www.iaeme.com/MasterAdmin/UploadFolder/IJCIET\\_09\\_08\\_181/IJCIET\\_09\\_08\\_181.pdf](http://www.iaeme.com/MasterAdmin/UploadFolder/IJCIET_09_08_181/IJCIET_09_08_181.pdf)
- Lankauskienė, T.; Tvaronavičienė, M. 2012. Security and sustainable development approaches and dimensions in the globalization context, *Journal of Security and Sustainability Issues* 1(4): 287–297. [http://dx.doi.org/10.9770/jssi.2012.1.4\(5\)](http://dx.doi.org/10.9770/jssi.2012.1.4(5))
- Luukkanen, J.; Kaivo-oja, J.; Vähäkari, N.; O'Mahony, T.; Korkeakoski, M.; Panula-Ontto, J.; Phonhalathb, K.; Nanthavongb, K.; Reinckec, K.; Vehmasa, J.; Hogarth, N. 2019. Green economic development in Lao PDR: a sustainability window analysis of green growth productivity and the efficiency gap, *Journal of Cleaner Production* 211: 818-829. <https://doi.org/10.1016/j.jclepro.2018.11.149>
- Mamdani, E. H. 1974. Application of fuzzy algorithms for the control of a simple dynamic plant, *Proceedings of the Institution of Electrical Engineers* 121(12): 1585-1588. <https://doi.org/10.1049/piee.1974.0328>
- Mazurkiewicz, J.; Lis, P. 2015. Ocena bezpieczeństwa energetycznego w wybranych krajach Unii Europejskiej [The assessment of energy security in selected European Union countries], *Rynek Energii* 4(119): 11-20. Retrieved from [https://www.researchgate.net/profile/Piotr\\_Lis/publication/281110415\\_Ocena\\_bezpieczenstwa\\_energetycznego\\_w\\_wybranych\\_krajach\\_Unii\\_Europejskiej/links/55e07b7508ae2fac471baf2d/Ocena-bezpieczenstwa-energetycznego-w-wybranych-krajach-Unii-Europejskiej.pdf](https://www.researchgate.net/profile/Piotr_Lis/publication/281110415_Ocena_bezpieczenstwa_energetycznego_w_wybranych_krajach_Unii_Europejskiej/links/55e07b7508ae2fac471baf2d/Ocena-bezpieczenstwa-energetycznego-w-wybranych-krajach-Unii-Europejskiej.pdf)
- Mazurkiewicz, J.; Lis, P. 2018. Diversification of energy poverty in Central and Eastern European countries, *Virtual Economics* 1(1): 26-40. Retrieved from [https://virtual-economics.eu/VE\\_1\\_1/Mazurkiewicz\\_Lis\\_2\\_VE\\_1\\_1\\_2018\\_26-41.pdf](https://virtual-economics.eu/VE_1_1/Mazurkiewicz_Lis_2_VE_1_1_2018_26-41.pdf)

- Miller, G. A. 1956. The magical number seven, plus or minus two: Some limits on our capacity for processing information, *Psychological Review* 63(2): 81-97. <http://dx.doi.org/10.1037/h0043158>
- Nordstrom, K. A.; Ridderstråle, J. 1999. *Funky business: talent makes capital dance*. Stockholm: Published by Bookhouse.
- Pajak, K.; Kamińska, B.; Kvilinskyi, O. 2016. Modern trends of financial sector development under the virtual regionalization conditions, *Financial and Credit Activity: Problems of Theory and Practice* 2(21): 204-217. <https://doi.org/10.18371/fcaptive.v2i21.91052>
- Pajak, K.; Kvilinskyi, O.; Fasiiecka, O.; Miśkiewicz, R. 2017. Energy security in regional policy in Wielkopolska region of Poland, *Economics and Environment* 2(61): 122-138. Retrieved from [https://www.ekonomaiairodowisko.pl/uploads/eis%2061/11\\_pajak.pdf](https://www.ekonomaiairodowisko.pl/uploads/eis%2061/11_pajak.pdf)
- Prakash, R.; Garg, P. 2019. Comparative assessment of HDI with Composite Development Index (CDI), *Insights into Regional Development* 1(1): 58-76. [https://doi.org/10.9770/ird.2019.1.1\(5\)](https://doi.org/10.9770/ird.2019.1.1(5))
- Raudeliūnienė, J.; Tvaronavičienė, M.; Dzemyda, I.; Sepehri, M. 2014. Sustainable entrepreneurship through energy stewardship: role of values and behavioral patterns, *Entrepreneurship and Sustainability Issues* 2(2): 107–117. [http://dx.doi.org/10.9770/jesi.2014.2.2\(6\)](http://dx.doi.org/10.9770/jesi.2014.2.2(6))
- Razminienė, K.; Tvaronavičienė, M. 2018. Detecting the linkages between clusters and circular economy, *Terra Economicus* 16(4):50-65 <https://doi.org/10.23683/2073-6606-2018-16-4-50-65>
- Rotshtein, A. 1998. Design and tuning of fuzzy rule-based systems for medical diagnosis, in Teodorescu, N.-H.; Kandel, A.; Gain, L. (Eds.). *Fuzzy and Neuro-Fuzzy Systems in Medicine*. New York: Published by CRC Press, 243–289.
- Saaty, T. L. 2001. *Decision making with dependence and feedback: the analytic network process: the organization and prioritization of complexity, second edition*. New York: Published by RWS Publications.
- Schleicher, J.; Schaafsma, M.; Vira, B. 2018. Will the Sustainable Development Goals address the links between poverty and the natural environment?, *Current Opinion in Environmental Sustainability* 34: 43-47. <https://doi.org/10.1016/j.cosust.2018.09.004>
- Shtovba, S. D. 2007. *Proektirovanie nechetkih sistem sredstvami MATLAB [Designing Fuzzy Systems by MATLAB]*. Moskva: Published by Goriachaia liniia – Telekom. (in Russian).
- Solarin, S. A.; Bello, M. O. 2018. Interfuel substitution, biomass consumption, economic growth, and sustainable development: Evidence from Brazil, *Journal of Cleaner Production* 211, 1357-1366. <https://doi.org/10.1016/j.jclepro.2018.11.268>
- Terano, T.; Asai, K.; Sugeno, M. 1994. *Applied Fuzzy Systems*. Boston: Published by Academic Press, Inc.
- Tkachenko, V.; Kwilinski, A.; Korystin, O.; Svyrydiuk, N.; Tkachenko, I. 2019. Assessment of information technologies influence on financial security of economy, *Journal of Security and Sustainability* 8(3): 379-390. [https://doi.org/10.9770/jssi.2019.8.3\(7\)](https://doi.org/10.9770/jssi.2019.8.3(7))
- Tvaronavičienė, M.; Šimelytė, A.; Lace, N. 2014. Sustainable development facets: exporting industrial sectors from inside, *Journal of Security and Sustainability Issues* 3(4): 37–44. [http://dx.doi.org/10.9770/jssi.2014.3.4\(4\)](http://dx.doi.org/10.9770/jssi.2014.3.4(4))
- Vosylius, E.; Rakutis, V.; Tvaronavičienė, M. 2013. Economic growth, sustainable development and energy security interrelation, *Journal of Security and Sustainability Issues* 2(3): 5–14. [http://dx.doi.org/10.9770/jssi.2013.2.3\(1\)](http://dx.doi.org/10.9770/jssi.2013.2.3(1))
- Yang, P.; Yao, Y. F.; Mi, Z.; Cao, Y. F.; Liao, H.; Yu, B. Y.; Liangade, Q. M.; Coffman, D. M.; Wei, Y. M. 2018. Social cost of carbon under shared socioeconomic pathways, *Global Environmental Change* 53: 225-232. <https://doi.org/10.1016/j.gloenvcha.2018.10.001>
- Zeibote, Z.; Volkova, T.; Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development* 1(1): 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))



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## ENVIRONMENTAL ENTREPRENEURSHIP: CHARACTERISTICS OF ORGANIZATION AND DEVELOPMENT

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**Abstract.** The growing awareness of environmental issues, such as the accelerated depletion of natural resources and declines in the quality of the environment, has led to the emergence of the concept of balanced (sustainable) development, which implies continual coordination with an equal focus on the following three key components of development – economic, social, and environmental. The purpose of this paper is to analyze some of the key characteristics of the development and organization of environmental entrepreneurship. The authors explore in detail the concept of environmental entrepreneurship. An expert survey was conducted to determine some of the key ideas for the development of environmental entrepreneurship, as well as some of the key prospects for integrating environmental aspects into entrepreneurial activity as a whole. Among the key areas for the development of environmental entrepreneurship listed in the paper are production of organic output, environmental construction, environmental tourism, and waste management and recycling. The authors provide an in-depth insight into some of the key principles and lines of activity on each of the areas mentioned.

**Keywords:** environmental entrepreneurship; ecologization; organic output; environmental construction; environmental tourism; waste management; recycling

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## 1. Introduction

In the late 20th century, with a focus on balanced development becoming an integral part of international and national development policy, growing attention began to be devoted to the concept of environmental entrepreneurship (EE). An analysis of views by various scholars has helped identify the following possible ways to construe the above concept:

- EE is a type of entrepreneurial activity which involves the use of all available means to reduce and eliminate the environmentally negative consequences of a company's activity and results in the pursuit of peculiarly ecofriendly production practices (Anisimov et al., 2008; Pakina, 2012; Cherniakhovskii, 2016; Smaliukienė, Monni, 2019; Polozova et al., 2019);
- EE is a form of entrepreneurial activity which is aimed at meeting a nation's environmental-economic needs through products with a set of features that are characterized by environmental usefulness, with the components of the environmental system predominantly viewed as factors that determine the nation's environmental-economic needs (Boboshko et al., 2006; Boboshko, 2006; Ershova, 2016);
- EE is a sector of the national economy which is concerned with both direct participation in the implementation of various environmental protection and resource saving programs and the mechanism for compensating losses incurred as a consequence of technogenic and natural emergencies, as well as in the course of the actual carrying out of relevant emergency management activities (Iashalova, 2012; Mamaeva, 2014).

Currently, the leaders in the implementation of environmentally oriented technologies and export of organic products are the United States, Japan and Western European countries. Germany owns 43% of environmental patents for products and goods. According to experts, the volume of production in the ecological market is estimated from 600 billion to 2 trillion dollars, with an annual growth rate of 5.5-7%. Green business in the G8 countries accounts for 12-25% of GDP (Mainstreaming Eco-Innovation in Sustainable Consumption and Production Policies, 2017).

In developed countries, the production of environmental technologies is most profitable, so the ecological market is booming. In 2017, the average annual turnover of the European market for environmental innovation at the beginning of the 21<sup>st</sup> century was 183 billion euros. An important result of its operation was the creation of 500 thousand new jobs in 2012-2017. In general, the European Union today makes the greatest contribution to the formation of the global market for innovative environmentally oriented technologies, the capacity of which is estimated at 550 billion euros (Eco-Innovation in Europe, 2019).

The structure of the European market for environmental innovation consists of investment goods (54 billion euros) and services (129 billion euros), including non-commercial services. The market sector for managing efficient use of resources accounts for 56 billion euros, and the current market turnover of alternative renewable energy resources and related equipment amounts to 5 billion euros per year (O'Brien et al., 2019).

As for the world market in general, the segment of environmental technologies is about 1000 billion euros per year and is considered an important factor in the development of the world economy today. 45% of this segment is occupied by technological solutions in the energy saving industry. The economic growth of the environmental technology market segment is about 5.4% per year and, according to experts, by 2020 it will be 2,200 billion euros per year (Nicolai, & Pillot, 2017).

Today, the market for organic agricultural products is one of the most dynamic and promising. The annual market growth in Europe is about 10%. According to the research organization Organic Monitor, more than 90% of consumers of organic products live in the United States and Europe. The American market for organic products is the largest, ranging from 47 to 53% of the total market capacity in different years. The countries with the largest

markets for organic products are the USA, Germany and France. The highest per capita consumption is observed in Switzerland, Denmark and Luxembourg. The largest market shares are in Denmark, Switzerland and Austria (Golijan, & Dimitrijević, 2018).

In Europe, 29% of the organic agricultural areas of the world is concentrated. The countries with the largest area of organic agricultural land are Spain (1.6 million hectares), Italy (1.1 million hectares) and Germany (1 million hectares). Seven European countries have a share of organic agricultural areas higher than 10% of all agricultural land: Liechtenstein (29.3%), Austria (19.7%), Sweden (15.2%), Estonia (14.8%), Switzerland (11.7%), Czech Republic (10.7%) and Latvia (10.4%). The largest market for organic products with a turnover of 6.6 billion euros is in Germany, which is followed by France (3.8 billion euros) and the United Kingdom (1.9 billion euros) (Organic Food in the EU, 2018).

European experience shows that 73% of organic products are promoted through a retail chain, 15% through direct sales from manufacturing enterprises and through markets, 12% are sold through specialized stores, including online stores. In addition, now special “organic” restaurants and cafes are appearing in the USA and Europe, dishes from organic products are offered in regular restaurants as well. A characteristic feature of modernity is the rapid development of the organic baby food market (Organic Food in the EU, 2018).

The integration of environmental aspects into entrepreneurial activity has long stopped being a mere trend – today, it is an integral part of regular entrepreneurship. Over the last decade, the EU’s EE sector has been among the areas which have exhibited the greatest growth (an annual increase of 3.8% in the number of green SMEs compared with an annual increase of 1.3% in the number of SMEs as a whole in the period 2010–2017 (Szabó, 2017)). Through the European Council, the governments of EU member states have declared fostering EE among SMEs and a shift to the green economy as key objectives in their policy of sustainable (balanced) development (Szilagyi et al., 2018).

The EU has in place a clear-cut policy aimed at support for SMEs willing to embrace EE practices. Its ‘Europe 2020’ strategy is aimed at fostering “smart, sustainable, and inclusive growth”. As part of its implementation of the above strategy, the EU adopted in 2014 the so-called ‘Green Action Plan for SMEs’ (European Commission, 2014), which is aimed at providing support to SMEs in terms of the use of various business opportunities associated with a shift to the green economy. This action plan is aimed at:

- boosting the efficiency of resource use by SMEs. This implies providing SMEs with information on how to boost the efficiency of use of resources (materials and energy), facilitating the transfer of green technology among SMEs, and providing SMEs with better access to funding.
- supporting EE. This implies promoting eco-innovation among SMEs, facilitating business partnering and cultivating relevant skills and knowledge related to EE, and augmenting the role of clusters in support of eco-innovative SMEs.
- facilitating access to the market for green SMEs. This implies promoting a greener European internal market, facilitating access to international markets for green entrepreneurs, and facilitating the implementation of resource efficiency technology in partner countries through cooperation with European SMEs.

The novelty of the study consists in determining, based on an expert survey, the possibilities of EE in individual branches of business and the measures necessary to obtain the benefits of integrating environmental aspects into entrepreneurial activity.

## **2. Methods**

As the study's primary method, the authors conducted a survey of experts in entrepreneurial activity (an expert study). The expert study provided a set of ideas for fostering EE and some of the potential prospects for integrating environmental aspects into entrepreneurial activity as a whole.

The survey procedure included the following activities: (1) specifying the gist of the issue under study and the motives for approaching a certain person as an expert; (2) gathering information which would substantiate an expert's competence, including information reflecting one's field of knowledge, expertise in the area, and qualifications; (3) preparing information which would form the basis of the survey questions; (4) designing the survey questions; (5) assessing the credibility of the experts' conclusions (views); (6) putting together additional remarks, comments, and suggestions.

As the study's theoretical subject, EE implies that a business adheres to the principles of environmental balance in its activity, strives to use renewable resources, and is committed to minimizing the negative impact its activity has on the environment. Certain aspects of this definition require additional clarification:

- entities engaged in EE activity adhere to regulatory requirements for environmental performance, with specific steps taken to continually improve this performance for the purpose of minimizing the negative impact on the environment;
- entities engaged in EE activity seek to turn out or supply traditional or new products and services in such a way as to minimize the negative impact on the environment;
- entities engaged in EE activity seek to employ resources and energy which are produced in such a way as to minimize the negative impact on the environment.

As the study's empirical subject, the authors engaged representatives of the business community and institutions associated with infrastructure for the support of entrepreneurship in Moscow Oblast. The expert sample consisted of 45 individuals, 9 of them being employees of the regional office of Rosprirodnadzor, 12 – employees of the Moscow Oblast Center of Support for Entrepreneurship, and 24 – executives and staff members of SMEs engaged in EE activity. The authors had deemed this number of experts to be requisite and sufficient to ensure maximum credibility in identifying a set of key opinions on the issue and prospects for the development of the situation.

### **3. Results and discussion**

In discussing the ideas for fostering EE, the experts have noted that fostering EE will help meet society's need for products and services that have less impact on the environment and those that may actually help improve its condition. Most of the ideas for fostering EE are founded on the community's growing awareness of the importance of environmental issues, which, in turn, creates a demand for ecofriendly products and services. Considering that the level of awareness of the significance of environmental issues is going to only increase over time, demand for ecofriendly products and services will also increase along with the potential for the development of green entrepreneurship.

Thus, initially, the experts have drawn the following two crucial conclusions on fostering EE:

1. There will be increases in demand for novel products and services that are ecofriendly, which are going to replace old products and services that are less ecofriendly. More specifically, there will be greater demand for waste recycling systems, which are expected to replace waste disposal systems.
2. Businesses will increasingly become aware of the need to demonstrate to consumers their commitment to the conduct of ecofriendly activity, if they are to retain and expand their client base. At present, there is already a growing trend among companies for striving to position themselves as ecofriendly.

Combined, these factors suggest that growth in the EE sector will surpass economic growth as a whole. The success of green business depends on its ability to win over the consumer based on the benefits it offers, including

the provision of high-quality products and services which will set it apart from the competition. Businesses ought to look for ways to provide consumers with products or services that are valued not only for their commercial characteristics but also because the production of these goods or services has less negative impact on the environment. However, green entrepreneurs may first have to identify potential benefits from their activity and study them intently with the consumer in mind in an attempt to anticipate how consumers may perceive their product or service, and then establish how to organize a marketing campaign that will help convince them to use that particular product or service. In this context, the experts have found the following to be of particular importance:

- the specific environmental properties of ecofriendly products or services: what exactly makes an ecofriendly product or service a top option from an environmental standpoint and what the best ways are to let the consumer know about it.
- the cost of ecofriendly products or services to the consumer: is the ecofriendly product or service more expensive than its traditional counterpart? If it is, then it may help to focus on telling the consumer about the item being much safer environmentally than its counterparts are so that the consumer could factor in its greater value and would not mind paying the high price for it.
- the overall image of the organization: companies operating in the EE sector may be seen by potential clients as a driving force behind the building of an “ecofriendly” future. The firm’s ability to effectively implement ecofriendly products or services may, thus, be closely associated with the way the company is perceived by the general public. If a company’s activity is not generally perceived as environmentally safe, it, accordingly, may have difficulty selling ecofriendly products and services.

The experts suggested that in certain sectors ecofriendly products and services could be implemented more easily and faster than in others. However, any sector can commit to prioritizing work methods that are safer environmentally and, thus, reduce the impact of its activity on the environment. Table 1 illustrates the potential of pursuing EE practices in a set of sectors, as formulated by the experts (listed in order of significance based on the number of mentions).

**Table 1.** EE Potential in Particular Sectors

Rank	% of mentions	Ideas for the development of EE	Key principles and areas of activity
1	75%	Production of organic output	<ul style="list-style-type: none"> <li>– development and use of a tracking system to make sure consumers can be confident that products referred to as ‘organic’ meet the international standards in that respect;</li> <li>– conduct of an ongoing public awareness campaign that will promote the consumption of organic products as a top food, lifestyle, and health choice;</li> <li>– obligating state-owned entities concerned with the production, processing, and sale of agricultural output to ensure full support for growth in the organic sector.</li> </ul>
2	67%	Environmental construction	<ul style="list-style-type: none"> <li>– effective use of energy, water, and other resources;</li> <li>– generation of electricity from turbine towers or solar batteries;</li> <li>– reduction of the volume of waste and reduction of other types of environmental impact;</li> <li>– use of local construction materials and products;</li> <li>– use of ecofriendly materials in construction and in the course of building-finishing activities;</li> <li>– use of biotechnological waste treatment techniques.</li> </ul>
3	54%	Environmental tourism	<ul style="list-style-type: none"> <li>– ensuring that the way in which tourism activity is conducted is aligned with a focus on keeping the area used as a tourism destination physically intact;</li> <li>– development of a system for reducing the consumption of natural resources (e.g., water and energy) by a tourism facility and/or of appropriate requirements for the management of its waste (i.e., wastewater and solid waste);</li> <li>– use of equipment that helps reduce the consumption of natural resources by a tourism facility and/or development of appropriate requirements for the management of its waste.</li> </ul>
4	46%	Waste management and recycling	<ul style="list-style-type: none"> <li>– utilization of waste from industrial, commercial, and administrative institutions which has the best potential for recovery and recycling (e.g., office paper and cardboard, plastic, various other packaging materials, and special waste, like electronic waste and tires)</li> </ul>



Ranked first among the experts' ideas for fostering EE was the production of organic output. It has been noted that Russia possesses significant potential for the production of organic agricultural output. However, a key barrier to development in the sector is the nation's insufficient legal framework in the area.

As an example, in the US, Europe, Japan, India, and China there are already in place well-developed systems for regulating organic agriculture. A number of post-Soviet nations (Kazakhstan, Moldova, Armenia, and Georgia), likewise, have in place legislation on organic agriculture. Russia is virtually the last developed nation where the concept of organic products has yet to be regulated on a statutory level.

With that said, based on official statistics (Mironenko, 2018), in the period 2010–2014 the Russian market for organic products posted an average growth of 10% per year, with the figure dropping between 2015 and 2016 to 4%. Note, however, that compared with the 2000s, when 100% of the nation's organic products were accounted for by imports, at present Russia's domestic certified output accounts for nearly 15–20% of its market for organic products. However, despite Russia's relatively decent performance in the area in absolute terms, its share in the global market is just 0.15%, i.e. at the level of a technical error.

With that said, for SMEs the production of organic output is a window of opportunity that can enable them to not just survive but actually compete on par with large agri-producers based on their ability to turn out high-quality organic products (Kaldiyarov et al., 2014).

According to the experts, the level of awareness about organic products among consumers, manufacturers, and government authorities in Russia is still quite low. Just like in other countries, the price of organic products is higher than that of traditional (non-organic) products. Accordingly, the development of the domestic organic market depends on the level of awareness among the population, purchasing power in the nation, and the level of supply (the availability of a full range of products).

Placed second among the experts' ideas for fostering EE was environmental construction.

Environmental construction is founded on the principles of energy conservation and environmental friendliness. This type of construction helps minimize the environmental impact of construction projects and reduce the costs of house maintenance, as well as ensure comfortable living conditions. It has been suggested that an important consideration not to be overlooked is the favorable influence of the microclimate in houses built based on the principles of environmental friendliness on people's health as a whole and their mood and emotional states in particular.

Over the last 10–15 years, the concept of environmental construction has progressively gained momentum and popularity throughout the world (Dudin et al., 2014; Dobrovolskienė et al., 2019).

Ranked third among the experts' ideas for fostering EE was environmental tourism.

Environmental tourism is a type of tourism which devotes special attention to protecting a region's environment and culture. At the same time, environmental tourism is often associated with the countryside and designated natural areas that remain untouched by human activity. It also covers activity in the tourism sector as a whole related to minimizing negative impact on the environment.

According to the experts, environmental tourism in the countryside and designated natural areas may come in a number of forms, the most common of which are the following:

- agrotourism, which implies visits by tourists to farms and/or their personal participation in agricultural activities;
- ethnographic and cultural tourism, which implies exposing tourists to specific social and public aspects of life in the area;



– tourism in designated natural areas, which implies having tourists explore the area's natural characteristics.

These types of tourism are quite common today and continue to be keenly developed in many countries across Europe. An interesting fact is that in developed countries environmental tourism is popular not only among medium-income citizens but among wealthy ones as well. This is particularly good for the development of small entrepreneurship in rural areas, as it can easily integrate to local conditions and can provide urban residents with the opportunity to experience environmental tourism the way they have always wanted to.

The potential for developing this form of tourism is there both at the microlevel (individual enterprises or homesteads) and at the level of large SMEs. This potential implies the following: lodging services; service provision (marketing services, guide services, etc.); food supply services; construction and site management services.

Placed fourth among the experts' ideas for fostering EE were waste management and waste recycling.

According to the experts, SMEs' potential in waste management implies the following: waste collection; waste treatment and recycling; waste disposal.

Potentially, the greatest potential for SMEs is in waste treatment and recycling, with most waste treatment and recycling technology being quite simple and easy to use and there being large amounts of raw materials that are available for recycling.

In many of the cases, no distinction is made between solid waste from industrial, commercial, and administrative institutions and solid waste from households. However, waste generated by industrial, commercial, and administrative enterprises is known to be easier to process than waste from households. A key factor is that waste from industrial, commercial, and administrative institutions is associated with their actual economic activity: the amount of various types of waste from them is typically not very large, while the volume of waste per unit of waste generated by them tends to be large as opposed to households. This means that it may be possible to gather significant amounts of raw materials for recycling from a relatively small number of industrial, commercial, and administrative institutions. Once this waste is gathered, sorting it will require less effort than sorting household waste.

The processing of organic waste (mainly compost) may require much time and sizable areas if one is not using cost intensive technology. However, in this context one may need to ascertain whether or not the costs of implementing finished compost are sufficient to substantiate the use of costly equipment. With that said, it has been suggested that the technological potential of complete recycling of organic waste into fertilizers is sufficient today to totally resolve the issue of managing organic waste.

It is possible to recycle household waste too, but this may be impractical if there is no agreement in place entered into with the local self-governing authorities.

As regards the possibility of integrating environmental aspects into entrepreneurial activity as a whole, in the sense that environmental aspects could be incorporated into a business's decision making process, the key views voiced by the various experts are outlined below.

Most SMEs and other business entities tend to view the environment as a secondary issue which hinders their activity. As a consequence, it oftentimes takes getting them to react to things in order to direct their attention to environmental protection. For instance, most will start paying attention to their environmental performance and take appropriate measures only in response to regulatory pressure from the supervisory authorities (Lipina et al., 2017). This kind of approach leads to measures being taken to resolve environmental issues after the fact: funds are expended on environmental control (particularly, pollutant control) after the problem is already there. From

this standpoint, investing in environmental priorities may be regarded as unproductive and may dent a company's financial viability.

The integration of environmental aspects helps prevent negative impact on the environment and minimize it with a view to reducing expenditure on control over the condition of the environment, as well as improve environmental and financial outcomes from a company's activity (Lochan et al., 2015). In many cases, the integration of environmental aspects requires the consideration of alternative ways to develop products or organize production and the use of alternative material inputs with a focus on the improvement of environmental indicators at various stages of production or when it comes to the use of a product. For instance, a manufacturer of paper may adopt a technology that requires the use of smaller volumes of water not only with a view to reducing expenditure on water during the process of paper production but also to helping minimize the costs of the wastewater treatment process. In other cases, certain resources may be adopted based on their environmental characteristics, to go with the rest of the corresponding factors. For instance, one may adopt packaging that could be recycled with a view to helping reduce waste management costs.

Virtually all SMEs could adopt a strategy of integration of environmental aspects. However, the actual potential for doing so will vary – depending on the type of activity they are engaged in. Some of the measures SMEs could undertake to derive gains from the integration of environmental aspects are listed in Table 2.

**Table 2.** Measures to Capitalize on the Integration of Environmental Aspects

No.	Measure	Gist	Activities
1	Environmental analysis	Establishment of environmental indicators of the firm's activity	Form a task group that will consist of representatives of each of the firm's key departments with a view to establishing an agenda of issues that are relevant for the entire company. Explore the possibility of enlisting the services of third-party specialists to engage them in work with the task group. Conduct environmental audits and assessments of expenditure which will encompass all aspects of the firm's environmental performance – more specifically, indicators of its "regular" activity related to the environment (e.g., the use of energy).
2	Environmental solutions	Determination of ways to improve the firm's environmental indicators	Explore the possibility of modernizing the firm's key business processes, including in the area of supply of new materials, as well as making changes to the firm's operating activity with a view to improving its environmental performance. Implementation of environmentally attractive options, most importantly solutions that are facilitative of reductions in the costs of resolving environmental issues after they arise.

The integration of environmental aspects should result in boosts in SMEs' efficiency – reductions in their expenditure and increases in their net revenue. Going forward, boosts in efficiency may well become a new standard for SMEs. By that time, the integration of environmental aspects will have naturally become part of a new standard for SMEs – an indispensable component of the practice of conducting entrepreneurial activity among SMEs. Thus, the cycle of integration of environmental aspects will be continued:

- environmental analysis will be updated periodically;
- there will be determined new potential for enhancement based on new technology and upgrades to revenue/expense structures;
- there will be proposed and implemented new types of activity.

Due to a number of operating and financial benefits it provides, the integration of environmental aspects is becoming a common element of activity for increasingly more SMEs. SMEs that sell their products directly to clients may gain an additional advantage, as their activity and products will be perceived as ecofriendly. This will

also result in boosts in revenue in markets where a product's environmental performance is an important consideration.

## Conclusions

Today, increasingly more entrepreneurs find it necessary to react to client demand for ecofriendly products and services. In this regard, they deliberately orient their products and services, as well as technologies and methods used to manufacture and supply those products and services, toward meeting the needs of their clients (who often desire to pay for ecofriendly products and services rather than traditional ones).

Among the key areas for the development of green entrepreneurship today are production of organic output, environmental construction, environmental tourism, and waste management and recycling.

A prospect for future research is analysis of the potential for the development of SMEs' environmental organizational potential and creation of appropriate conditions for fostering green entrepreneurship.

## References:

- Anisimov, A. P., Ryzhenkov, A. Ia., Chernomorets, A. E. 2008. *Ekologicheskoe predprinimatel'stvo: Problemy i perspektivy* [Environmental entrepreneurship: Issues and prospects]. Cheboksary, Russia: ChGU. *Pravovoe prostranstvo Rossii: Opyt i sovremennost'* [Russia's legal space: Best practices and today's state of affairs], 7–10.
- Boboshko, V. I., Gusev, A. A., Potravnyi, I. M. 2006. Osobennosti ekologicheskii orientirovannogo malogo predprinimatel'stva v Rossii [Characteristics of environmentally oriented small entrepreneurship in Russia]. *Ekonomika Prirodopol'zovaniya* 5: 31–40.
- Boboshko, V. I. 2006. Razvitie malyykh predpriyatiy v sfere ekologicheskogo biznesa [Development of small enterprises in the environmental sector]. *Ekonomika Prirodopol'zovaniya* 4: 102–114.
- Cherniakhovskii, E. R. 2016. Perspektivy razvitiya ekologicheskogo predprinimatel'stva [Prospects for the development of environmental entrepreneurship]. *Ekonomika Prirodopol'zovaniya* 4: 88–93.
- Dobrovolskienė, N.; Tvaronavičienė, M.; Tamošiūnienė, R. 2017. Tackling projects on sustainability: a Lithuanian case study, *Entrepreneurship and Sustainability Issues* 4(4): 477–488. [http://doi.org/10.9770/jesi.2017.4.4\(6\)](http://doi.org/10.9770/jesi.2017.4.4(6))
- Dudin, M. N., Prokofev, M. N., Fedorova, I. J., Frygin, A. V. 2014. The world experience of transformation of innovative approaches to assurance of financial stability of social economic systems. *Life Science Journal* 11(9): 370–373.
- Eco-Innovation in Europe: A Policy Brief from the Policy Learning Platform on Environment and Resource Efficiency*. 2019. [https://www.interregeurope.eu/fileadmin/user\\_upload/plp\\_uploads/policy\\_briefs/TO6\\_Policy\\_brief\\_on\\_eco-innovation.pdf](https://www.interregeurope.eu/fileadmin/user_upload/plp_uploads/policy_briefs/TO6_Policy_brief_on_eco-innovation.pdf)
- Ershova, T. V. 2016. Ekologicheskoe predprinimatel'stvo: Osnovnye napravleniya i etapy razvitiya issledovaniy [Environmental entrepreneurship: Key areas for and stages in the development of research]. *Vestnik Sankt-Peterburgskogo Universiteta. Menedzhment* 1: 66–90.
- European Commission. 2014. Green Action Plan for SMEs: Enabling SMEs to turn environmental challenges into business opportunities. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0440&from=EN>
- Golijan, J., Dimitrijević, B. 2018. Global organic food market. *Acta Agriculturae Serbica* XXIII(46): 125–140.

Iashalova, N. N. 2012. Formirovanie rynka ekologicheskikh uslug kak faktora sotsial'no-ekonomicheskogo razvitiya regiona [Building the market for environmental services as a factor in socio-economic development in a region]. *Regional'naya Ekonomika: Teoriya i Praktika* 37: 19–26.

Kaldiyarov, D. A., Sharipov, A. K., Bedelbayeva, A. E. 2014. Development of the concept of the optimum mechanism of government administration by economy of agro-industrial complex of the Republic of Kazakhstan [Special issue]. *Life Science Journal* 11(7): 394–400.

Lipina, S. A., Lochan, S. A., Fedyunin, D. V., Bezpalov, V. V. 2017. Government promoting communication tool in innovation development of companies. *European Research Studies Journal* 20(4B): 536–547.

Lochan, S. A., Fedyunin, D. V., Bezpalov, V. V., & Petrosyan, D. S. 2015. Theoretical issues of the formation of the industrial policy of enterprises [Special issue]. *International Journal of Economics and Financial Issues* 5(3): 274–280.

*Mainstreaming Eco-Innovation in Sustainable Consumption and Production Policies: United Nations Environment Programme*. 2017. [http://unep.ecoinnovation.org/wp-content/uploads/2018/03/UNEP\\_157-Mainstreaming-ecoInnovation\\_web.pdf](http://unep.ecoinnovation.org/wp-content/uploads/2018/03/UNEP_157-Mainstreaming-ecoInnovation_web.pdf)

Mamaeva, L. N. 2014. Razvitie ekologicheskogo predprinimatel'stva [Development of environmental entrepreneurship]. *Agrarnyi Nauchnyi Zhurnal* 11: 91–92.

Mironenko, O. V. 2018. *Organicheskiy rynek Rossii. Itogi 2017 goda. Perspektivy na 2018 god* [Russia's organic market. Results for 2017. Prospects for 2018]. <http://rosorganic.ru/files/Mironenko%20Analitika%202017-18.pdf>

Nicolaï, I., Pillot, J. 2017. Promote and Support Eco-innovation. *International Journal of Sustainable Development: Inderscience* hal-01715029. <https://hal.archives-ouvertes.fr/hal-01715029/document>

O'Brien, M., Doranova, A., Kably, N., Kong, M. N., Kern, O., Giljum, S. 2018. Eco-Innovation of products: Case studies and policy lessons from EU Member States for a product policy framework that contributes to a circular economy. In *Eco-Innovation Observatory: Biannual Report 2018*. [https://ec.europa.eu/environment/ecoap/sites/ecoap\\_stayconnected/files/documents/eio\\_report\\_2018.pdf](https://ec.europa.eu/environment/ecoap/sites/ecoap_stayconnected/files/documents/eio_report_2018.pdf)

*Organic Food in the EU: Background paper*. 2018. [https://www.eca.europa.eu/Lists/ECADocuments/BP\\_ORGANIC\\_FOOD/BP\\_ORGANIC\\_FOOD\\_EN.pdf](https://www.eca.europa.eu/Lists/ECADocuments/BP_ORGANIC_FOOD/BP_ORGANIC_FOOD_EN.pdf)

Pakina, A. A. 2012. Prirodopol'zovanie i "zelenaya" ekonomika: Ekologo-ekonomicheskie aspekty regulirovaniya [Natural resource management and the "green" economy: Environmental-economic aspects of regulation]. Moscow, Russia: MGU. *Ratsional'noe prirodopol'zovanie: Teoriya, praktika, obrazovanie* [Rational natural resource management: Theory, practice, education], 98–106.

Polozova, T.; Musiienko, V.; Storozhenko, O.; Peresada, O.; Geseleva, N. 2019. Modeling of energy-saving processes in the context of energy safety and security, *Journal of Security and Sustainability Issues* 8(3): 387-397. [https://doi.org/10.9770/jssi.2019.8.3\(8\)](https://doi.org/10.9770/jssi.2019.8.3(8))

Smaliukienė, R.; Monni, S. 2019. A step-by-step approach to social marketing in energy transition, *Insights into Regional Development* 1(1): 19-32. [https://doi.org/10.9770/ird.2019.1.1\(2\)](https://doi.org/10.9770/ird.2019.1.1(2))

Szabó, A. 2017. *Green SMEs in the European Union*. 15th International Conference on Management, Enterprise and Benchmarking, Budapest, Hungary. [https://kgk.uni-obuda.hu/sites/default/files/34\\_Szabo%20Antal.pdf](https://kgk.uni-obuda.hu/sites/default/files/34_Szabo%20Antal.pdf)

Szilagyi, A., Mocan, M., Verniquet, A., Churican, A., Rochat, D. 2018. Eco-innovation, a business approach towards sustainable processes, products and services. *Procedia: Social and Behavioral Sciences* 238: 475–484.

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## ECONOMIC SANCTIONS AND IMPORT SUBSTITUTION\*

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**Abstract.** The article focuses on the economic sanctions theory development in the modern global economy. The content of the economic sanctions theory and practice transformation under the influence of internationalization and globalization of markets for goods and services is disclosed. The study analyzes the economic content of sanctions. The goals and grounds for imposing sanctions are defined. The authors classify the types and forms of economic sanctions applied in the modern global economy. The conditions for achieving an impact of economic sanctions are formulated. The attempt is made to assess the economic efficiency of sanctions and their counter-sanction measures. The losses and consequences, both for the countries imposing the sanctions and for countries under pressure, are identified. Factors affecting the distribution of losses from the imposition of economic sanctions are disclosed. The main directions of the economic sanctions content and application practice transformation in the global economy are identified.

**Keywords:** Economic and political sanctions; embargo; import substitution; motives; goals; loss; consequences; sanctions pressure; countries subject to sanctions; countries imposing sanctions

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**JEL Classification:** F13, F42, F51

### 1. Introduction

Thus far, economic literature still does not have a precise and comprehensive definition of economic sanctions, and the mechanism for their imposing, the reasons and grounds that influence the decision-making process on imposing sanctions, are not explicitly defined and transparent. Economic sanctions have become a frequent international practice, while the political and legal aspects of the imposing have not been determined yet. This

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state of things clearly indicates that this process needs theoretical understanding in the globalizing world, especially today, when there is a transformation of the very process of imposing sanctions: it acquires specific features and new consequences both for the countries subject to sanctions and for those imposing them. And it is very important to find an answer to the question that was bluntly raised during the discussion on sanctions: are they new opportunities for cooperation, or highly negative set of factors and threats that destroy the economy subject to sanctions?

## **2. Theoretical and Methodological Grounds of the Research**

To analyze the economic content of sanctions, reasons, and grounds for their imposing, as well as the types of economic sanctions and their economic efficiency, it is necessary to use the main approaches of system analysis, including structural and reproduction, as well as genetic and institutional approaches. The "economy of sanctions" as a field of research is an integral part of the institutional theory. It is represented in the works of Western academic economists to the fullest extent possible since sanctions are an important element of the current foreign economic policy. Thus, various aspects of the economic sanctions study outcomes are presented in the works of such scientists as G.C. Hufbauer (Hufbauer et al. 2009), Th. Madies (Madies et al. 2013), S. Oxenstierna (Oxenstierna and Olsson 2015), Chen-yuan Tung (Tung 2002), J. Galtung (Galtung 1967); O. Finogentova (2018).

The interest in the economic sanctions study arose in Russia only in recent years after the imposition of certain external restrictions. At the same time, the growing interest of Russian academic scientists to this problem is concentrated today mainly on the applied aspects of sanctions and their counter-sanction effects (Klimova 2016). At the same time, the theoretical aspects of the economic performance study under conditions of sanctions are not enough. The content of economic sanctions, their types, methods and forms of application and other aspects of this problem require additional study.

## **3. Results**

The theory of sanctions has a long history, beginning with Ancient Rome. Western researchers gave particular prominence to the development of this theory related to institutional economics, while Russian scientists, including Soviet ones, did not pay enough attention to the analysis of the content, economic consequences of the application of these categories and the implementation of sanctions pressure processes. Over the last years, after imposing the sanctions by Western countries, Russian scientists addressed this issue, in the study of which a whole series of new questions arise.

Today the theory of sanctions under the conditions of the global economy is undergoing a very serious transformation due to the existing global markets for goods and services, the enhanced international division of labor, which leads to completely different consequences both for countries subject to sanctions and for those imposing them.

The global economy is so closely linked to the economic, political and social interests of countries that conceivably it becomes impossible to create operating conditions for the existence of an autarkic economy. Obviously, this negates the consequences of imposing sanctions. Another important new point is a fundamental change in the conditions for achieving the efficiency of economic sanctions, which cannot always lead to the desired consequences, that is, to the political and economic outcomes, to achieve which significant resources and funds have been spent.

What are economic sanctions, what is their content as an economic category?



At the broadest level, sanctions are certain restrictive measures against certain states, separate companies or individuals used as a response to any action. The obstacles for their activities created in this way can not only affect certain areas of development and the sphere of the economy but also be inclusive. Restrictions, obstacles, and difficulties to activities caused by sanctions are manifested at all levels of economic management. Their main goal is to create adverse conditions for the economy of the country, its subjects at the federal and regional levels, thereby calling them to change the chosen behavior strategy.

A conventional approach presumes that international legal sanctions are measures of compulsions that are applied centrally by the UN as a part of the collective security system. World practice includes the following influence restrictions as for the states:

- economic sanctions;
- political sanctions.

Economic measures mean a weakening of the economic situation and concern the restriction (perhaps even a complete prohibition) of foreign trade. For example, a state may impose a prohibition of goods export to the country that has been restricted. The prohibition also extends in the opposite direction: import of the same production stops. Since for most states, international relations are built on trade, suppliers lose market outlets, and consumers cannot purchase a number of goods, as their import is stopped. They have to look for new channels, which is connected with certain inconveniences and additional costs. In our opinion, the restrictions imposed on the import of goods are more severe and destructive. This is due to the fact that the countries-sellers under the conditions of the current heavy competition for product markets face the problem of selling the products. The goal of imposing political and economic sanctions is to achieve a situation where the state, the object of imposed restrictions, will be isolated to some extent from the rest of the world.

In most existing studies, economic sanctions are identified namely as an enforcement tool or a means of destabilization that applies to states, enterprises or a group of individuals (mainly members of national and regional elites), when they act contrary to the rules set by international rules. With this in mind, it should be emphasized that, in this connection, the content of the category "economic sanctions" is narrowed by focusing only on its political and legal component against its economic interpretation. At the same time, only in some publications, there is the opinion that sanctions can be both negative and positive by the nature of their impact (Baldwin 1971; Madies et al. 2013). Examples include humanitarian and investment assistance, the use of customs preferences.

Basically, sanctions are a severance of integration and cooperation ties, this is, as such, a blow to the theory and practice in the international division of labor, which ultimately reduces the costs of manufactured products, taking into account its production under the best possible conditions (Borisovskaya 2015; Zeibote et al. 2019). Sanctions challenge the import substitution, that is, the development of a closed autarkic reproduction system, regardless of real costs and rejecting the advantages of making maximum use of the international division of labor. Thus, they contradict the interests of the mutually beneficial contribution of countries in the system of international cooperative interaction and prevent the obtaining of benefits and advantages from the development of international trade. The importance of the political component of sanctions should also be noted since economic sanctions are often imposed in order to achieve certain political goals.

G.K. Hufbauer et al. used the following definition of economic sanctions: deliberate, government-inspired withdrawal, or threat of withdrawal, of customary trade or financial relations with political goals (Hufbauer et al. 2009).

The grounds for imposing sanctions are as follows:

- demonstration of resolve to achieve the desired political goal, which is the most frequent reason for sanctions;

– prevention of the future problem behavior of the subject of international relations limiting its political and economic independence;

–the interest of the country's authorities imposing the sanctions in demonstrating a strong foreign economic policy but at the same time their unwillingness to engage in open military conflicts.

The imposition of economic sanctions by a country or a group of countries has always been connected with the enforcement by the government of the countries that are subject to sanctions to change their policy. As a rule, sanctions are expressed by the prohibition of the import and/or export of goods and services, the restriction of financial transactions with corporations of these countries, the termination of economic partnership and investment.

An illustrative transformation example of the content and practice in the application of economic sanctions under the conditions of global peace is the situation concerning the Russian Federation. 2014 was a turning point for Russia, both politically and economically. The reason for the virtual isolation of the country in the world was the unstable situation in Ukraine and the annexation of the Crimea. The reaction was the imposition by 48 Western countries of several sets with economic sanctions. Although sanctions have been in effect for a long time, there have not been convincing impact ratings yet. Moreover, there is no common opinion about the full impact and losses of sanctions, not only in quantitative terms but even on a qualitative level.

What are the consequences of the imposition of economic and political sanctions against the Russian Federation? Experts state that the greatest difficulties arise in the sphere of import (Shevchenko 2017). The fact is that the Russian economy is quite dependent on the importation of high technology, engineering products, medicine and, considerably, food supplies. The main import partner is exactly the EU, which imposed sanctions. The result of the sanctions was a reduction in trade between Russia and the EU (table 1).

**Table 1.** The EU-Russia external trade turnover from January to July, USD million

	2014	2015	2016	2017	2018	2018 to 2014, %
EU countries	232278	143156	107965	137105	168233	72.4
from them:						
Belgium	7925	5248	4633	5704	7165	90.4
Germany	41219	27270	21441	27235	33651	81.6
Spain	5867	2968	2494	3061	3540	60.3
Italy	29975	19606	10831	13187	14998	50.0
Latvia	9228	5047	3166	3459	3004	32.6
Netherlands	45038	27217	18289	23098	26176	58.1
Poland	14689	8339	6579	8824	12037	81.9
Slovakia	5146	3279	2205	2905	3281	63.8
United Kingdom	12349	6989	5668	6688	8116	65.7
Finland	10102	5728	4647	6762	8711	86.2
France	11694	6558	6918	8363	10242	87.6
Czech Republic	6263	3588	2827	4045	4772	76.2

Source: Russian Federal State Statistics Service (n.d.).

Today the economic component of the relevant measures has a systemic nature, which led to a serious price advance on the domestic market, primarily on food products, as well as to the deficit of certain types of imported products. The impact of sanctions on the Russian economy was also manifested in the reduction of the volume of foreign investment capital attracted (Sinyakov et al. 2015). In 2014, the leading bond rating agencies significantly lowered the credit ratings of the Russian Federation, which, in fact, are an important indicator of the country's attractiveness to foreign capital. It is worth noting that nowadays the Russian economy is largely dependent on foreign capital. Whereas, the RTS and MICEX stock exchanges provide liquidity in large part due to attracting

foreign investment capital (Shevchenko 2017). The result of the reduction in the inward investment into the country's economy was a GDP deceleration in 2014-2016 from 1.8% to 0.5%.

The entire set of anti-Russian sanctions suggests the following directions for its implementation:

- 1) organizational and institutional sanctions, manifested in the suspension of Russia's membership in a number of international agencies.
- 2) individual sanctions, i.e. restrictions against senior officials (restrictions on entry and financial investments in banks of Western countries).
- 3) sets of sectoral sanctions against leading branches of the Russian economy. From July 16, 2014, the first economic sanctions of this kind were announced. Credit organizations such as Vnesheconombank, Gazprombank, Rosneft and Novatek oil companies, as well as enterprises of the defense industry, including Almaz-Antey, Izhmash, Uralvagonzavod, Concern Kalashnikov and others, got restricted. Then Russian Agricultural Bank, Bank of Moscow following by VEB, Sberbank, VTB were subjected to sanctions. They were not only forbidden to be credited to the US and the EU but also to provide services in these countries.
- 4) investment sanctions, i.e. the cancelation of investment cooperation, the cessation of financing for new projects in Russia.

As a reaction to imposed sanctions, the Russian Federation imposed an embargo on the import of certain types of agricultural products, raw materials and food from the United States, the EU and other countries supporting economic sanctions. Other counter-sanction actions by the Russian government were the following:

- prohibiting the entry into the country's territory to a number of politicians and statesmen of the United States and other countries;
- accelerating the work on putting in operation its own payment system (MIR);
- developing and implementing the accelerated import substitution program. Thanks to this policy, new enterprises are set up, focused on the production of high-tech products, which were previously imported;
- restricting the public procurement of consumer goods in Western countries.

The most damaging and negatively affecting of the Russian economy state are financial sanctions. The greatest potential for the emergence of threats for the country's economy is exactly in the financial and credit branch, the analysts say (Borisovskaya 2015; Osipov 2014). The fact is that the Russian banking system is so integrated into the world that foreign financial experts actually have access to key mechanisms for its management.

When analyzing the impact of financial sanctions on the economy of country subject to sanctions, it is necessary to take into account the impact not only of sanctions having a direct effect (restrictions on foreign borrowings by Russian issuers), but also of all other types of financial sanctions, including those having indirect and secondary effects. Indirect effects are due to a decrease in net capital inflow as a result of increased financial risks. Indirect effects have a large number of components, including reducing the borrowings of all other issuers, a decrease in the inflow of direct foreign and portfolio investments, and, possibly, an increase in the outflow of the Russian capital.

Secondary effects are connected with the economy reaction to a reduction in net capital inflow under conditions of an aggressive reduction in its import and even to a "stop of capital inflow" (SCI). This leads to a decrease in apparent demand, the decline in production, primarily due to a decrease in investment.

Today the global economy puts forward fundamentally new problems for science that cannot be resolved within the framework of the classical theory of sanctions, and require its transformation taking into account the adaptation to the rapidly changing conditions of the world economy. There is an urgent need, for example, to identify the conditions for achieving the efficiency of sanctions. In general, in the economic literature, the efficiency of sanctions is viewed in the context of achieving political goals and is determined by the threat or real damage to the economy and the unacceptability of such losses for the country.

In the context of an interconnected and interdependent world, there is a clear tendency towards the success of counter-sanction measures. Moreover, they are not always reflecting ones. This poses the question of identifying conditions under which sanctions can be efficient.

The evaluation of the international experience in the implementation of sanction pressure allows us to formulate the following conditions for achieving the effect of imposing economic sanctions:

- a significant degree of the country's import dependence in most sectors of the economy affected by the sanctions;
- limited opportunities to replace imported goods, both through the development of national production, and as a result of diversification of foreign economic relations;
- control of foreign economic operations in the country subject to sanctions by the countries imposing them, due to the geographical location and difficulty (impossibility) of products transportation, etc. (Osipov 2014).

In our opinion, the most important condition for achieving effects from the imposition of different sanctions is the heavy dependence of the state on external supplies of the most important goods, for example, food or consumer goods, and the impossibility of their rapid import substitution. Only in this case, various kinds of restrictions will be efficient. Although, the example of Russia clearly showed that the imposition of sanctions and the reactive food import embargo predetermined an active import substitution policy, which resulted in a significant increase in national agricultural production against the significant losses of European farmers (Figure 1).

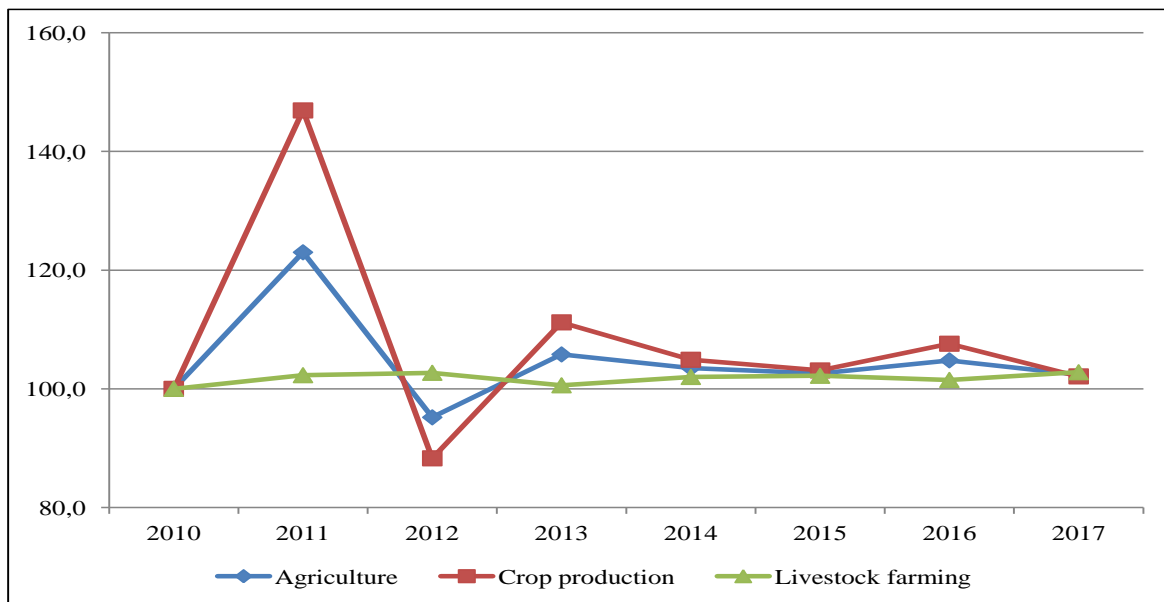


Figure 1. Production indices, % to previous year

There are other results of the import substitution policy. The dependence of the Russian food market on imports has significantly decreased (Table 2). In addition, import substitution policy at the initial stage usually causes an economic recovery.

**Table 2.** Share of Imports of Certain Products in the Total Pool of Russia's Commodity Resources, %

Product	2013	2014	2015	2016
Meat and poultry, including byproducts	26.2	19.6	13.4	11.0
Beef, including byproducts	59.0	57.3	48.1	40.2
Pork, including byproducts	31.0	16.6	12.5	9.5
Poultry meat, including byproducts	12.8	10.0	5.5	5.0
Canned meat	20.0	13.7	9.0	9.1
Sausage products	3.2	2.2	1.0	1.4
Animal oils	35.9	34.3	25.5	26.3
Cheeses	48.0	37.3	23.3	22.8
Flour	1.5	0.9	0.8	1.9
Groats	1.8	0.5	0.3	0.2
Vegetable oils	19.0	14.4	17.4	16.3
Dried milk and dried cream	60.5	49.4	56.4	59.6
Confectionery	12.0	9.3	5.9	5.9
Sugar	8.2	7.4	6.2	5.5

Source: Russian Federal State Statistics Service (n.d.).

Another important direction in the transformation of the classical sanction theory is the need for better differentiation of losses and consequences of sanction interaction for countries that impose sanctions (political, economic, individual and other) from the consequences for countries that are subject to restrictions.

Factors that affect distribution of losses from sanctions are the following:

- the losses for the country subject to sanctions to a large extent are determined by its share in world GDP and the aggregate share of countries imposing sanctions;
- the degree of import intensity and dependence of production in countries, which are subject to sanctions and the possibilities of prospective import substitution;
- the economic efficiency of the management system in a country subject to sanctions.

To assess the impact of sanctions on the economic performance of Russia, E. Gurvich and I. Prilepskii constructed projected values for the two scenarios (with the oil price USD 100 and USD 50 per barrel), firstly assuming no sanctions, and then taking into account limited access to finance (Gurvich and Prilepskii 2016). The authors note that the impact of sanctions is enhanced by the fall in oil prices, as the loss records of capital inflows as a share of GDP increase. The consequences of sanctions are largely compensated (by about 40%) by a reduction in the Russian capital outflow. The total additional net capital outflow connected with sanctions can be estimated at USD 58 billion in 2014 and USD 160-170 billion in 2014-2017 (Table 3). According to the authors' calculations, sanctions against the Russian Federation have a rather painful impact on the real economy indicators: accounting only their financial components leads to a loss of 2.4% of the pre-crisis GDP in 2017 (with the oil prices of about USD 50 per barrel) at simultaneous reduction in investment and consumption. At the same time, a significantly more sensitive shock for the Russian economy was the fall in oil prices. According to economists, it leads to a loss of 8.5 percentage points of total growth during 2014-2017 (Gurvich and Prilepskii 2016).

**Table 3.** Assessment of the impact of sanctions on capital flows in 2014-2017, USD billion

Indicator	High oil price	Low oil price
Gross capital inflows	-276,0	-281,5
Debt obligation	-184,1	-184,1
Foreign direct investment	-79,5	-85,2
Obligations of public authorities	-12,4	-12,4
Gross capital outflow	-114,3	-113,2
Net effect of sanctions	-161,7	-168,1
Net effect of sanctions in % of GDP	-1,9	-2,8

*Source:* Gurvich and Prilepskii 2016

Expert loss estimations from financial sanctions in the Russian economy are the following (Gurvich and Prilepskii 2016; Regnum 2017; Shevchenko 2017; Shirov et al. 2015):

- European sanctions cost Russia EUR 23 billion in 2014 and about EUR 75 billion in 2015;
- net capital outflow caused by sanctions is estimated at USD 58 billion in 2014 and USD 160-170 billion for the period 2014-2017 by the experts;
- total losses of net capital inflow for this period amount 8% of GDP in 2013, accumulated losses of GDP are 6 percentage points of GDP in 2013.

In September 2015, Citigroup estimated the contribution of sanctions to Russia's GDP decline as of 10%, while the remaining 90% was caused by a fall in oil prices (Lenta.ru 2015). It can be concluded that the sanctions made only a minor contribution to the recession of the Russian economy: a more significant reason for weakening of the national currency and negative economic growth was the fall in oil prices. Nevertheless, the sanctions have undoubtedly caused some negative impact. They contributed to inflation, albeit to a much lesser extent than the weakening of ruble, which is dependent on oil price quotations. In addition, the Western investment inflow has declined significantly, with the exception of several large energy transactions. Since early 2014, Russian banks and industrial companies have had to pay about USD 250 billion of foreign debt. This is comparable to 20% of GDP at the current exchange rate. Obviously, this gravely affected the country's economy.

What are the consequences of imposing sanctions on the countries-initiators? The losses of the European countries from the sanction war between the West and Russia as of April 2017 amounted to about USD 100 billion over the past three years, which is twice the loss of Russia. Moreover, according to some analysts, most of the losses were not due to Russian counter-sanctions, but because of the Western sanctions themselves (Shevchenko 2017). The loss in income of the countries that imposed the sanctions is about USD 3.2 billion per month, while the losses of the Russian side are estimated at USD 52-55 billion, which is 1% of the country's GDP (TASS 2017).

The analysts of the French institute for research into international economics, Center d'Etudes Prospectives et d'Informations Internationales, hold to an opinion about the reverse impact of sanctions. In mid-2016, they estimated that only from the beginning of 2014 to June 2016, 37 countries that supported sanctions against Russia, received less than USD 60.2 billion (Expert online 2016). At the same time, 82% of all losses accounted for the export of products fallen within the scope of the Russian food import embargo. Researchers also concluded that the bulk of these losses are related specifically to the sanctions themselves, and not to the reactive food import embargo imposed by Russia.

The economy of Europe, and not of the United States, suffered most from the imposition of restrictions. The EU countries suffer 76.7% of all losses from trade restrictions with Russia. For example, Germany's losses in favor of continuing the policy are over USD 832 million per month (RIA Novosti 2016). This can be explained by the fact that the Nord Stream gas pipeline appears in Germany, and in the near future there are plans to lay the Nord



Stream-2. In addition, German enterprises were widely represented in the Russian market, which resulted in the largest impact. The reduction in the buying capacity of the Russian population was largely reflected in the German automobile concerns, in particular Volkswagen and BMW, which started their production in Russia.

Thus, Germany lost not only from the prohibitions on access to the Russian market, but also from the general reduction of this market as such. It should be noted that the largest relative share in trade flow with Russia fell to Germany, what is more for high-tech goods with high value added (RIA Novosti 2016). Other countries suffered significantly from the imposition of restrictions: France accounted for 5.6% of all losses, Britain had 4.1%.

The main outcomes of the impositions of sanctions for Russia became a significant reduction in the social standard of living, caused by the rise in price of imported goods (Figure 2) and the growth of user prices against the background of a reduction in salary, the growth of credit costs, a decline in business activity and economic stagnation.

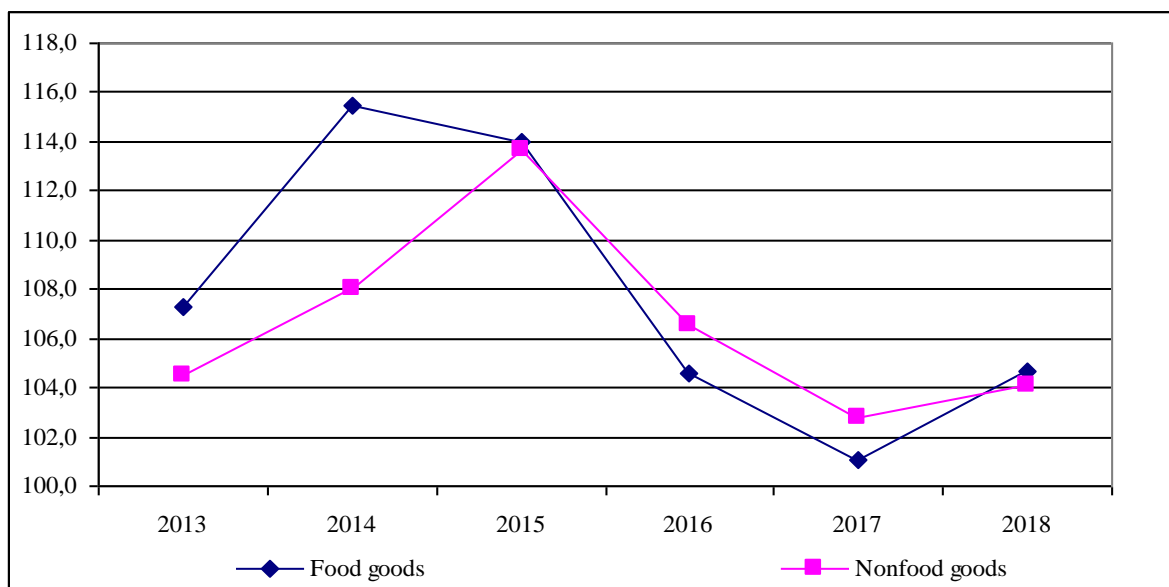


Figure 2. Consumer price index, % (December to December of previous year)

However, in addition to negative ones, there are certain positive aspects of the impact of sanctions on a number of branches. For example, Russian agriculture could significantly increase the volume of food production precisely due to European competitors exit from the market.

A logical consequence of the sanctions was the diversification of Russia's foreign economic ties and the gradual reorientation of Russia to cooperation with Asian countries, particularly with China. External trade turnover of these countries increased by 14.6 %.

#### 4. Discussion

In view of the foregoing, it is possible to identify the following directions of the transformation in the theory of sanctions:

1. To a larger extent, the losses for the country subject to sanctions are determined by its share in world GDP and the aggregate share of countries imposing sanctions. If in the world output the share of the countries imposing sanctions is small, they cannot have a significant impact on the development prospects of the country. In the case of Western sanctions against Russia (48 countries, whose share in the world gross product is about 60%), effective import substitution becomes practically impossible. The country subject to sanctions should ensure, in a



short period, the replacement of economically sound interactions on the world market with forced foreign economic ties.

2. Since sanctions in the global economy represent a severance of integration and cooperation ties, this cannot but affect the overall decline in labor productivity on a global scale and represents a refusal from the international division of labor. Thus, the losses from sanctions are sustained by all countries that somehow participate in sanctions and counter-sanction measures. An important outcome and negative consequence of sanctions is the deceleration in the overall growth rate of the world economy.

3. Another transformation direction of the theory of sanctions under modern conditions is the diversification process of types and forms of sanctions. The imposition of sanctions is increasingly important in the form of restrictions on individual sanctions, in the form of political restrictions of various kinds, restrictions in the form of non-admission to the largest events.

## 5. Conclusions and recommendations

The study of the countries' sanction interaction under the conditions of the existing global markets for goods and services, the enhanced international division of labor and the presence of other characteristics of the global economy make it possible to make a judgement on a duplicitous nature of economic sanctions both on the countries subject to sanctions pressure and those imposing sanctions. The negative reverse impact of sanctions on the countries imposing them should also be taken into account. The goals of the pressure applied are very difficult to achieve today, and the impact of sanctions can be small, as the country-subjects are gradually adapting to external challenges and threats.

A characteristic feature of the sanction policy implementation is the presence of significant overall losses, which are borne by the countries in the modern interconnected world from the severance of integration and cooperation ties. In fact, it is a blow to the theory and practice of the international division of labor, which ultimately reduces the costs of manufactured products, taking into account its production under the best possible conditions.

All of the above factors make us rethink the classical theory of sanctions and make new emphases in characterizing sanctions as an economic category and process.

## References

- Baldwin, D. A. 1971. The Power of Positive Sanctions, *World Politics*, 24(1): 19–38.
- Borisovskaya, K. A. 2015. Ekonomicheskie interesy Rossii i otsenka importo-zameshcheniya prodovol'stviya v usloviyakh sanktsii [Russian economic interests and assessment of food import substitution under the sanctions], *Vestnik Rostovskogo gosudarstvennogo ekonomicheskogo universiteta RINKh* 3(51): 69–76.
- Expert online. 2016. *Khoteli sanktsii?* [Did you want sanctions?]. Available on the Internet: <http://expert.ru/2016/07/6/pribyil-nedostupna/>
- Finogentova, O.; Tokarev, V.; Petrenko, M.; Primak, T. 2018. Acceptance criterion of state coercion in contemporary society, *Entrepreneurship and Sustainability Issues* 6(2): 820-829. [http://doi.org/10.9770/jesi.2018.6.2\(23\)](http://doi.org/10.9770/jesi.2018.6.2(23))
- Galtung, J. 1967. On the Effects of International Economic Sanctions: With Examples from the Case of Rhodesia, *World Politics* 19(3): 378–416.
- Gurvich, E. T.; Prilepskii, I. V. 2016. Vliyanie finansovykh sanktsii na rossiiskuyu ekonomiku [The impact of financial sanctions on the Russian economy], *Voprosy Ekonomiki* 1: 5–35.
- Hufbauer, G. C.; Schott, J. J.; Elliot, K. A.; Oegg, B. 2009. *Economic Sanctions Reconsidered*. 3d ed. Washington, D.C.: Peterson Institute for International Economics.

Klimova, N. I. 2016. “Ekonomika sanktsii” kak oblast' nauchnykh issledovaniy: teoreticheskie osnovy i polozheniya [“Economy of sanctions” as an area of scientific research: theoretical basis and provisions], *Fundamental'nye issledovaniya* 5–2: 357–361.

Lenta.ru. 2015. *Vklad sanktsii v padenie rossiiskogo VVP otsenili v 10 protsentov* [The contribution of sanctions in the fall of Russian GDP was estimated at 10 percent]. Available on the Internet: <https://lenta.ru/news/2015/09/28/citi/>

Madies, Th.; Laurila, H.; Golliard, M. 2013. *Economic Sanctions: Embargo on Stage. Theory and Empirical Evidence*. Fribourg: Universitas Friburgensis, University of Tampere.

Osipov, V. S. 2014. Politicheskaya ekonomiya sanktsii (novaya agrarnaya politika) [The political economy of sanctions (new agrarian policy)]. *Vestnik Federal'nogo gosudarstvennogo obrazovatel'nogo uchrezhdeniya vysshego professional'nogo obrazovaniya “Moskovskii gosudarstvennyi agroinzhenernyi universitet im. V.P. Goryachkina”* 3: 62–64.

Oxenstierna, S.; Olsson, P. 2015. *The economic sanctions against Russia Impact and prospects of success*. Stockholm.

Russian Federal State Statistics Service. (n.d.). Pokazатели, kharakterizuyushchie importozameshchenie v Rossii [Indicators characterizing import substitution in Russia]. (in Russian). Available on the Internet: [http://www.gks.ru/wps/wcm/connect/rosstat\\_main/rosstat/ru/statistics/importexchange/#](http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/importexchange/#)

Regnum. 2017. *Evroeksperty: poteri ES ot sanktsii protiv RF ischislyayutsya milliardami evro* [Euro experts: EU losses from sanctions against Russia amount to billions of euros]. Available on the Internet: <https://regnum.ru/news/2331334.html>

RIA Novosti. 2016. *Rossiiskie sanktsii okazalis' antizapadnymi* [Russian sanctions turned out to be anti-Western]. Available on the Internet: <https://ria.ru/analytics/20160706/1459937828.html>

Shevchenko, A. 2017. *Sanktsii Zapada protiv Rossii: kto teryaet bol'she?* [Western sanctions: who loses more?]. Available on the Internet: <https://riss.ru/smi/43483>

Shirov, A.; Litovskii, A.; Potapenko, V. 2015. Otsenka potentsial'nogo vliyaniya sanktsii na ekonomicheskoe razvitie Rossii i ES [Evaluation of the potential effect of sanctions on the economic development of Russia and the European Union], *Problemy prognozirovaniya* 4: 3–16.

Sinyakov, A.; Roitman, A.; Seleznev, S. 2015. *Dinamika potentsial'nogo VVP Rossii posle neftyanogo shoka: rol' sil'nogo izmeneniya otnositel'nykh tsen i strukturnykh zhestkosti* [Dynamics of Russia's potential GDP after the oil shock: The role of big change in relative prices and structural rigidities]. Moscow: Bank of Russia Publ.

TASS. 2017. *Spetsdoklad OON: poteri Zapada ot sanktsii prevysili poteri RF v dva raza* [Special UN report: loss of Western sanctions exceeded the losses of the Russian Federation twice]. Available on the Internet: <http://tass.ru/ekonomika/4220141>

Tung, C.-Y. 2002. *China's economic leverage and Taiwan's security concerns with respect to cross-strait economic relation*. PhD thesis. Baltimore, MD: Johns Hopkins University.

Zeibote, Z.; Volkova, T.; Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development* 1(1): 33–47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))

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## A MODEL FOR MANAGING THE INNOVATION-DRIVEN DEVELOPMENT OF A REGIONAL INDUSTRIAL COMPLEX

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**Abstract.** A key structural issue in the innovation-driven development of Russia's regional industrial complexes (RIC) to face over the next 5–10 years is “filling”, in the context of the contribution of industrial production to GDP, the niche currently occupied by the resource and raw materials sector of the national economy (in particular, enterprises within the fuel-and-energy complex). This issue of filling the gaps in GDP is quite complex and requires considerable resources and significant statutory effort. Ideally, this process must involve galvanizing RIC's use of innovative technology, with a special strategic focus on creating high-tech industrial production operations. Since RICs are a key subject of the innovations market, it may be worth exploring the effect of the innovations market on these complexes, while also investigating their own self-development processes in the context of organizing and implementing innovation activity. It is also worth noting that the effect of the innovations market on RICs is manifested in all major segments within the innovations market: federal, sectoral, regional, corporate, and intra-firm.

**Keywords:** managing innovation-driven development; regional industrial complex; innovations market; innovative products; institutional-innovation environment; management model

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**JEL Classification:** O3

### 1. Introduction

An investigation of relevant trends in and laws governing the innovation-driven development of a regional industrial complex (RIC) helped establish that, given the keen use of innovations, it will be as many as 5–7 years before the innovation-driven development of these complexes results in high-tech production operations gaining a firm foothold and starting to help achieve high rates of GDP growth (as active and influential structural elements) – and that is provided that the timeframes for carrying into effect relevant plans for conducting innovation activity and interacting with participants in the innovations market are observed. Therefore, in the near future the

innovation-driven development of RICs will predominantly be associated with the traditional raw materials sector and with the services sector. As a result, the process of new sectors taking over for the raw materials sector, as well as the development of the infrastructural segment of the national economy, will proceed at quite a slow pace, with a major breakthrough unlikely to be achieved soon in terms of galvanizing innovation activity and creating an adaptive innovation space in the national economy. Under these economic conditions, one of the most strategically effective and realistic ways is to consolidate small creative, innovation-focused enterprises around integrated establishments, which should involve the provision of statutory support for these concentration processes and proper coordination on the part of public authorities (Ignatavičius et al. 2015; Tvaronavičienė, Černevičiūtė, 2015; Valter et al. 2016; Tvaronavičienė, 2017; Razminienė, Tvaronavičienė 2017; Monni et al., 2017; Goncharenko et al., 2019; Petrenko et al., 2019).

Today's practice of providing support for innovation-driven development requires developing an adaptive model for managing innovation activity in RIC. The focus specifically ought to be on employing a sound adaptive system, as opposed to undertaking plain measures of traditional support for RICs, which have failed to result in the desired effectiveness and efficiency of investment in the creation of innovative products and services.

## 2. Methods

If it is changes taking place in the corporate segment of the innovations market that are taken as the basis for RIC's self-development, a key focus here must be on putting in place relevant standards designed to ensure the coordination of the interests of innovation-focused agents within the RIC (Aniskin et al. 2009). In this case, it may be easier to identify a set of rational procedures of innovation marketing and come up with proper tools for developing and implementing RIC's technological and investment policy, which should help forecast changes in the brand portfolio of enterprises within the complex.

As regards RIC's self-development by way of changes in the intra-firm segment of the innovations market, here it will help to put in place and make rational use of proper standards for effective activity by the divisions of business entities within the RIC in developing and implementing innovations. This may help identify principal sources of reserves for the support of the innovation-driven development of RIC, as well as help build a system of proper principles for making and implementing effective innovation-related decisions, which is highly crucial today for ensuring the rational operation of innovation infrastructure facilities within RICs.

With that said, rationalizing the use of and selecting a particular form of managing RIC's innovation-driven development in a climate of interaction with the innovations market is closely linked with developing relevant strategies and scenarios for the innovation-driven development of specific enterprises within the RIC and of the entire RIC as a whole.

**Table 1.** Methods for Managing RIC's Innovation-Driven Development Depending on Particular Segments within the Innovations Market

Segment/ subsystem	Method for managing innovation-driven development	Input information for RIC	Output information from RIC
Federal segment	Administering strategic control over the development of situations in the 'innovations – target markets' area	Scientific-technical, technological, statistical, and patent information, as well as hindsight data	Information related to the fine-tuning of strategic priorities for innovation-driven development
Sectoral segment	Developing a system of effective management of innovation projects; coordination and control of the formation and development of a project portfolio	Information on the availability of unique resources required for the production of innovative output	Information on innovation projects accepted for implementation; information on the volume of and timeframes for getting the resources

Segment/ subsystem	Method for managing innovation-driven development	Input information for RIC	Output information from RIC
Regional segment	Selecting appropriate forms of stimulating and providing continual support for an active strategy for innovation-driven development	Information on the trends in and prospects for statutory and legislative regulation of innovation activity in the economy	Information on key partners to the RIC in the context of innovation activity and criteria for fostering rational cooperation with them
Corporate segment	Conducting a set of activities on creating within the RIC a proper innovation management climate	Information from experts obtained in assessing the trends in and prospects for organizing and managing innovation activity in a socio- economic system	Information on the experience of developing and implementing innovative solutions and the choice of area for developing and implementing innovations factoring in the competence level of RIC personnel
Intra-firm segment	Ensuring the maximum decentralization of managerial powers, whilst preserving the integration relationships	Information on the participants in innovation activity and the potential for coordinating their activity at the level of resource and organizational support	Information on the conditions of and potential for the transfer of experience and knowledge in the RIC for the purpose of integrating all levels of innovation management
Scientific- methodological subsystem	Ensuring the RIC's appropriate reaction to a number of strategic issues	Information on possible scenarios for the development of various areas of technology and science; information on potential technological horizons	Catalogues and datasheets for innovation projects, products, and technologies offered for implementation to investors by the RIC
Innovation subsystem	Searching for new and developing existing markets for innovative products which are within the strategic zones of the RIC's responsibility	Information on whether there are currently in place functioning prototypes, special authorization procedures, systems of environmental regulations, and market barriers (the degree to which it is possible to sell various components or materials independently factoring in the potential for those sales to be blocked by competitors)	Information on newly developed innovative products within the RIC
Economic subsystem	Rational use of strategic resources within the RIC; rational exchange of resources	Information on the structure of target markets; RIC segments in them; levels of demand; levels of supply; competitors; consumers; competing goods; suppliers; general economic trends; sectoral trends; risks inherent in the development and implementation of innovations	Information on implemented market and economic mechanisms for organizing and managing innovation activity within the RIC
Organizational- managerial subsystem	Putting in place strategic sets of structures acting as strategic business processes	Information on the commercial potential of technological innovations and on tools for promoting projects on commercializing technologies within the RIC	Information on assistance provided by the RIC to small enterprises engaged in the implementation of risky innovation projects
Infrastructural subsystem	Developing and implementing strategic plans on infrastructural support for innovation activity programs	Information on entities operating in the area of support for innovation and technological activity within the RIC, including information on sources of resource support for independent infrastructural projects within the RIC (leasing)	Information on quantitative and qualitative indicators of the sufficiency of infrastructural support for innovation within the RIC

*Source: elaborated by authors*

Another major method for managing RIC's innovation-driven development is foresight, which is a key area of research activity by participants in innovation activity within the RIC. These issues must be explored in conjunction with issues related to the development and implementation of a program for the innovation-driven development of RIC.

### 3. Results

As at January 1, 2017, Russia ranked 43rd among 128 countries in the Global Innovation Index. To note, there was a 5-percentage point improvement relative to the same period of 2016. The top three spots in the Global



Innovation Index were occupied at the time by Switzerland, Sweden, and Great Britain. Of interest is the fact that, compared with its performance as at January 1, 2014, Russia moved up the ranks in innovation input, however, its performance worsened in innovation output, with the nation's efficiency in the development and implementation of innovations having declined steadily over the years. In addition, the nation has failed to be among the world's top 100 nations in the following indicators: Innovation Linkages, Investment, State of Cluster Development, Regulatory Quality, and Political Stability.

In the Bloomberg Innovation Index, as at January 1, 2017, Russia was one of the 50 nations with the worst dynamics in terms of the development of innovation activity, ranking 26th versus 12th in 2016. However, it should be noted that Russia led the way in relative share of certified specialists, expenditure on innovation, and number of patents registered. In effect, while possessing sufficient scientific-technical potential, Russia appears to have failed to make efficient use thereof within the national and regional economies – in 2017 the nation ranked 24th in relative share of high-tech enterprises within its RICs, versus 8th in 2016.

As at January 1, 2017, the relative share of the output of science-driven and high-tech sectors relative to the nation's GDP was 22.3% (Popkov & Kotsiubinskii, 2017). It also should be noted that in Russia the approach to construing the term “science-driven and high-tech products” varies from institution to institution. For instance, the Ministry of Industry and Trade of the Russian Federation has yet to recognize as existing the sectors concerned with the manufacture of computers, electric equipment, and optical and electronic products. Having said that, materials by the above institution do address innovation activity in the area of design and manufacture of bicycles. Only the Russian Federal State Statistics Service appears to observe the commonly accepted international approach in terms of associating industrial output with its high-tech varieties.

As evidenced from Table 2, the Ministry of Industry and Trade of the Russian Federation considers the level of innovation activity in the country to be (two times) higher than Rosstat does. Oftentimes it is hard to assess the level of innovation activity in Russia due to the fact that they never reflect in analysis the level of output's novelty. This results in the erroneous view that innovation activity by particular enterprises, as opposed across an entire RIC as a whole, is a sufficient indicator of high levels of engagement of business entities in innovation processes.

**Table 2.** An Assessment of the Level of Innovation Activity in the Russian Federation Based on the Number of Innovation-Focused Companies and Indicators of Production of Innovative Output

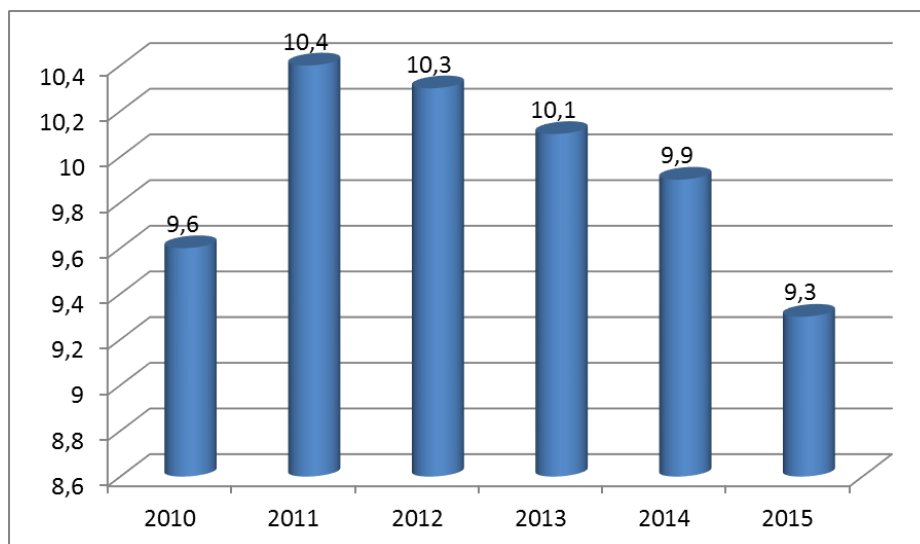
	Area of activity	Volume of innovative output with ‘of own production’ status, trillion rubles		Number of companies, thousand units
		2015	2016	
Russian Federal State Statistics Service	High-tech production operations	2.048	2.248	1.32
	Medium-tech production operations	5.384	5.799	3.78
	Science-driven production operations	8.644	9.382	94.32
Ministry of Industry and Trade of the Russian Federation	High-tech production operations	5.45	5.731	5.99

*Source:* Compiled by authors

When it comes to percentage-based relationships, more specifically the relative share of enterprises engaged in technological innovation (R&D) in the nation's total number of enterprises, they accounted for 7.3% (2016), based on information from Rosstat. Here the way was led by the Central Federal District (nearly 9%), with the rear brought up by the North Caucasian Federal District (just 2.6%). A major negative trend is the steady decline in the relative share of innovation-focused enterprises, which started back in 2011 (Figure 1).



As at January 1, 2017, innovative products turned, works carried out, and services provided accounted for around 12% of the nation's combined total. Here the way was led by the Central Federal District (nearly 15%), with the rear brought up by the Far Eastern Federal District (around 1.5%).



**Fig.1.** Dynamics of the relative share of innovation-focused enterprises in the Russian Federation

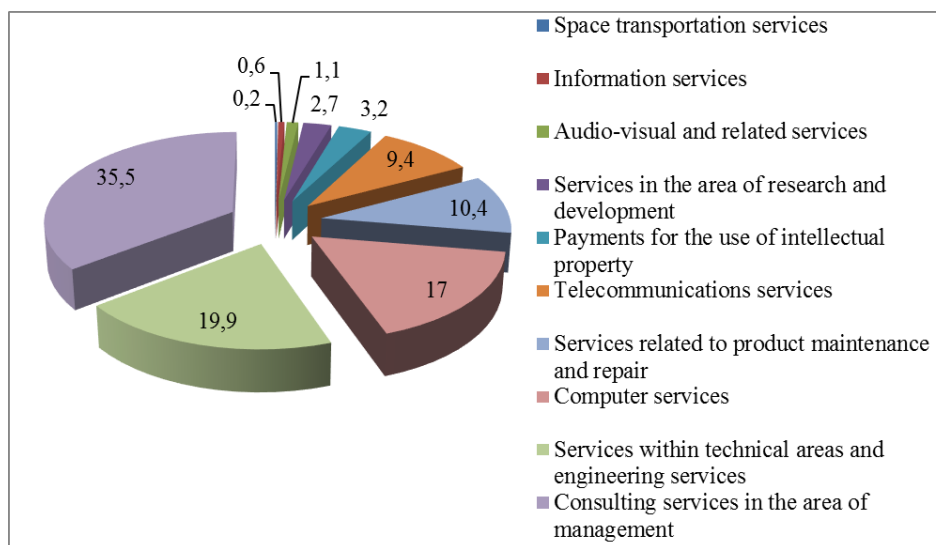
*Source:* Rosstat data (n.d.)

The share of all expenditure incurred in developing technological innovations relative to the overall volume of all goods produced, works carried out, and services provided as at January 1, 2017 was 2.5% across Russia as a whole. Leading and trailing positions were distributed similar to the regions' positions based on the share of innovation-focused enterprises. As at January 1, 2017, the volume of internal expenditure on the conduct of research and innovation activities was about 1.1% relative to total GDP. It should also be noted that in Russia's budgets for the period 2016–2017 the share of expenditure on implementing civil science activities declined steadily (a decline of 14% in 2016).

Based on data from the Industrial Research Institute, in 2016 nearly 60% of all expenditure on R&D was accounted for by the US, Japan, China, and Germany, with Russia's relative share coming in at just 2.6%. A key negative factor is the lack of interest on the part of businesses in potentially taking part in funding support for the R&D sphere. As evidenced from the National Report on Issues of Innovation in Russia, the nation lags significantly behind other countries in funding support for R&D – and that is considering the input of even the nation's largest enterprises within RIC's. Russian enterprises operating within the nation's aviation and space industries, oil-and-gas sector, and automotive industry currently spend 2-3 times less than their counterparts in the leading countries of the world. Consequently, currently there is not a single Russian enterprise and not a single Russian RIC that is ranked among the best globally in expenditure on research and development, which reduces significantly the potential for the export of high-tech goods from Russia.

During the period 2016-2017, high-tech exports from Russia totaled around \$18-19 billion. In 2016, the figure was \$18.3 billion, with 63% of that accounted for by military-use products. Russia's key partners in that area include Algeria, Egypt, China, India, Kazakhstan, Belarus, and Iran. High-tech and intellectual goods and services accounted for around 30% of the nation's total exports of goods and services. This normally includes the following goods and services: goods and services related to space transportation, payments for the use of products of intellectual activity, computer, information, and telecommunications goods and services, services related to

research and development, services related to consulting on issues of management, goods and services related to architecture, services related to product maintenance and repair, and various engineering services. Note that the greatest levels of revenue from the export of high-tech and intellectual goods and services in Russia were registered in 2013 (\$19.9 billion). 2014 saw the emergence of a trend toward declines in the above exports, which had to do with sanctions pressure on Russia. In 2016, the nation's turnover in the area was \$14.9 billion. Figure 2 illustrates the structure of Russia's present-day export of high-tech and intellectual goods and services (Russia's Balance of Payments for 2016, n.d.).



**Fig. 2.** Structure of the export of high-tech and intellectual goods and services from the Russian Federation in 2016.

*Source:* Compiled by Authors

Operations on the import of technology were, above all, dominated by engineering services (around 50%). A high relative share was also exhibited by deals related to the acquisition of rights to trademarks and means of individualization (around 20%). The share of know how in the nation's total imports was much greater than that in its total exports (around 5.7% versus 1.3%) (Likhachev, 2017). Note that Russia's export-import balance on innovative products and technologies is characterized by negative dynamics throughout the period under analysis. For instance, in 2016 the balance reached its worst level – \$1,222 billion, which means there is a need to take urgent measures to properly organize innovation activity in Russian industry both nationally and regionally.

It will also be worth devoting some attention to the sector in the innovations market which is concerned with products of intellectual activity. Note that, based on data from Clarivate Analytics, in 2016 Russian scientists published about 50,000 works. All in all, publications by Russian scientists accounted for 2.12% of total world publications (with Russia ranking 15th globally in publication activity level).

There is a key trend that may be illustrated by the fact that in 2016 out of 230,000 in-effect invention patents Russia's RICs made use of just 15,000 patents (around 7%). A similar situation was observed in relation to all other products of intellectual activity as well: out of 53,000 in-effect patents for utility models the nation's RICs utilized just about 5,800 (around 11%), while out of 30,500 patents for industrial designs only 1,800 were implemented by RIC enterprises (around 5.8%). All this substantiates the fact that, while processes related to making use of products of intellectual activity are well-organized in Russia, processes related to commercializing them in RIC's may still require additional serious work. It should also be noted that oftentimes it happens that applications associated with obtaining a patent for an invention do not meet the criteria for RICs with respect to

patentability (with around 20% of all decisions on granting a patent based on verdicts by industrial clients ending up negative).

## Discussion

The above is testimony to the significance of putting together a proper model for managing the innovation-driven development of the nation's RICs, which would enable the rational and adaptive influence of participants in the innovations market on enterprises operating within the complex. In particular, within the setting of the federal segment the effect of the innovations market on RICs is reflected in the formation of a system of national needs for new types of innovative products, which is determining the nature of future economic activity in RICs in the context of federal special-purpose programs to be implemented. Also, within the setting of the federal segment of the innovations market there can be established civilized rules and conditions regarding the development, implementation, and rational use of products of innovation activity by business entities that form part of or are partners to RICs (Lvov & Sorokin, 2005).

Within the setting of the sectoral segment, the effect of the innovations market on RICs is manifested in the formation and development of key institutional components which help ensure effective innovation activity at the sectoral and intersectoral levels of interaction between RIC and its partners. Also, within the setting of the sectoral segment of the innovations market there can be ensured crucial information and consulting cooperation between RIC and its partners on issues related to obtaining and putting to rational use innovative technologies and knowledge from participants in the sector with a view to boosting RIC's innovation potential and competitiveness (Kleiner, 2002). Finally, within the setting of the sectoral segment the effect of the innovations market on RICs is associated with that at this level of organizing innovation activity in the national economy there takes place the fine-tuning of relevant priorities and areas for the operation of sectors within the nation's industry and services sphere, which helps RICs distribute their resources in the right and judicious way across various programs and projects on innovation-driven development based on the criterion of boosts in the added value of innovative products turned out.

Within the setting of the regional segment, the effect of the innovations market on RIC is reflected in ensuring the conditions for the formation and timely manifestation of RIC's demand for R&D products by participants in the innovations market, which helps model in the right way the system of funding and insuring the risks of programs and projects on RIC's innovation-driven development. Also, within the setting of the regional segment the effect of the innovations market on RIC helps strengthen relevant interrelationships and improve the effectiveness of interaction between RIC and its partners on R&D, which may result in well-balanced cycles for creating innovative products (Iasin, 2009).

Within the setting of the corporate and intra-firm segments, the effect of the innovations market on RIC is manifested in that objects and subjects of the innovations market can accumulate best practices from various nations around the world in the area of organizing and managing innovation activity within RICs, with those best practices becoming accessible, through constructing experience curves and exchanging knowledge, for particular enterprises within RIC to enable them to effectively implement relevant programs and projects on innovation-driven development. Also, the effect of the innovations market on RIC within the setting of the corporate and intra-firm segments is reflected in the expansion of the conditions and potential for implementing a rational exchange of resources among participants in innovation activity, as well as the creation of an effective culture and a favorable innovation environment, which should stimulate inventor proaction and personnel creativity in the RIC.

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graph TD
    subgraph TopRow [ ]
        direction LR
        A[Objectives for managing innovation-driven development]
        B[Choice and characterization of subjects in the innovations market which influence RIC]
        C[Types of management of innovation-driven development]
    end

    subgraph LeftBlock [Self-development block]
        direction TB
        D[Technological policy]
        E[Investment policy]
        F[Innovation management and knowledge management]
        G[Innovation marketing]
    end

    subgraph RightBlock [Block of interaction with market segments]
        direction TB
        H[Regulatory framework]
        I[Taxation system]
        J[System of funding and insuring innovation projects]
    end

    K[Cultivation of innovation potential]
    L[Transformation of innovation potential into innovation capital]
    M[Outcomes from managing the RIC's innovation-driven development]
    N[Boosts in the RIC's competitiveness]

    A --> K
    B --> L
    C --> J
    D --> K
    E --> L
    F --> L
    G --> L
    H --> K
    I --> L
    J --> L
    K --> L
    L --> M
    M --> N
    N --> G
    
```

**Objectives for managing innovation-driven development**

**Choice and characterization of subjects in the innovations market which influence RIC**

**Types of management of innovation-driven development**

**Self-development block**

- Technological policy
- Investment policy
- Innovation management and knowledge management
- Innovation marketing

**Block of interaction with market segments**

- Regulatory framework
- Taxation system
- System of funding and insuring innovation projects

Cultivation of innovation potential

Transformation of innovation potential into innovation capital

Outcomes from managing the RIC's innovation-driven development

Boosts in the RIC's competitiveness

*Source:* Compiled by Authors

The coordination block determines relevant objectives for and corresponding types of management of innovation-driven development within RIC in accordance with the intensity of interaction between the RIC and various subjects in the innovations market. The relevance of the topic of managing innovation-driven development within RIC is associated with the need to combine services of industrial production and intensive innovation activity by business entities within the complex for the purpose of resolving a wide spectrum of organizational and managerial issues by way of ensuring the differentiation of the qualitative characteristics of innovation and production processes, as well as existing approaches to the effective management of these processes (Berg, 2000).

This approach to marking out a set of key components of management of innovation-driven development within RIC in a climate of interaction with the innovations market is associated with the centralization of the conduct of a set of basic research studies, as well as with the augmentation of processes of decentralization of innovation activities and ongoing improvements in innovative products and services from participants in the innovations market. What is actually manifesting itself here is the key principle of building the concept of managing innovation-driven development within RIC – the principle associated with the separation of strategies for innovation-driven development from tactics for the conduct of innovation activities (Milner, 2010).

Below is an outline of the key subjects in the innovations market, based on the above-examined segments, which influence activity within RIC the most. The subjects in the federal segments of the innovations market which influence activity within RIC the most include federal research universities and state-run research centers. Federal research universities make it possible to implement the above-mentioned trend of decentralized innovation activities, which serves today as a basis for the diversification of innovative activity within RIC. Also, federal research universities can have a major effect on intellectual potential in RIC via the preparation of highly skilled and competent specialists who possess both basic and applied skills in organizing innovation and managerial business processes (Sapir & Blinova, 2009).

The key subjects in the sectoral segment of the innovations market which influence activity in RIC the most include technology parks and business incubators. The effect of technology parks on RIC is associated with the conduct of R&D activities and creation of trial designs of innovative products in them, which potentially may be of interest to enterprises within the RIC in terms of brand portfolio adaptation. It should also be taken into account that modern technology parks possess vast distributed bases of innovative resources which could be integrated into RIC's well-balanced innovation infrastructure, which may have a tangible effect in terms of transforming relevant priorities in organizing innovation processes in the RIC (Shevtsov, 2011).

The key subjects in the regional segment of the innovations market which influence activity in the RIC the most include regional innovation-technological centers, as well as regional centers for technology transfer. Regional innovation-technological centers can influence the prospects for innovation-driven development in RIC in the sense that they can take on the organization of the region's functional fairs for innovative products from economic entities within the RIC, which helps foster a sustainable and high demand for innovative solutions in the RIC (Akat'ev et al., 2009). Also, regional innovation-technological centers are oriented toward the organization of work dealing with the integration of the RIC's technological and economic sectors into the national and world innovation activity systems, which finds reflection in consulting for the RIC on issues related to deploying production operations in a region that have a focus on innovation, as well on issues related to support (participation of strategic partners) for research work in the RIC.

The key subjects in the corporate segment of the innovations market which influence activity in RIC the most include engineering establishments and agencies concerned with examination of innovation and investment projects. These subjects of the corporate segment facilitate better rationalization of prospective innovation activity organized in the RIC and help model innovation processes with enhanced characteristics in terms of resource intensity, infrastructural intensity, and efficient implementation.

Lastly, the key subjects of the intra-firm segment of the innovations market which influence activity in RIC the most include information networks and systems for transfer of knowledge among the personnel of business entities within the RIC. These subjects of the intra-firm segment help the RIC boost the effectiveness and promptness of managerial decision making. In other words, these subjects influence the efficiency of processes related to enhancing and expanding the potential for rational use of the system of managing innovation activity in the RIC.

Below is an itemized account of the effect of subjects of the various segments within the innovations market on activity and the prospects for managing innovation-driven development in RIC based on a set of relevant methods and mechanisms for ensuring the subjects' influence on the organization of innovation processes in the RIC.

Subjects of the federal segment within the innovations market influence RIC via:

- the following methods: provision of support for strategic priorities for innovation activity; cultivation of international cooperation; creation of a favorable investment climate; protection of industrial products of intellectual activity;
- the following mechanisms: budgetary funding and lending; public-private partnerships; materialization of the outcomes from implementing scientific-technical policy.

Subjects of the sectoral segment within the innovations market influence RIC via:

- the following methods: facilitation of modernization; facilitation of competition in the innovation sphere; development of leasing of high-tech products; protection of the rights to own, use, and dispose of the results of innovation activity;
- the following mechanisms: coordination of economic interests; enhancement of economic interestedness; pricing stimulation (setting target prices and establishing concessionary prices); depreciation incentives.

Subjects of the regional segment within the innovations market influence RIC via:

- the following methods: development of the supply of innovations; expansion of the demand for innovations; development of small innovation-focused entrepreneurship; ensuring employment in the innovation sphere; protection of the rights and interests of business entities that are partners to the RIC on innovation activity; ensuring sustainable economic growth;
- the following mechanisms: market promotion; market expectations; shaping demand preferences; regional management (ensuring the link between innovations and regional priorities, adapting regional legislation, and developing regional innovation and structural policies).

Subjects of the corporate segment of the innovations market influence RIC via:

- the following methods: development of innovation infrastructure and improvement of the level of infrastructural intensity of innovations; development of integration processes; investing in innovations and boosting their effectiveness; development of contractual relationships; creation of coordination centers for innovation activity;
- the following mechanisms: adaptive management; creation of adaptive systems; infrastructural support; provision of scientific-methodological support (regulation of the organizational-legal characteristics of business activity; selection and implementation of various areas of planning, forecasting, and control over the outcomes of developing and implementing innovations; ensuring a rational exchange of resources).

Subjects of the intra-firm segment of the innovations market influence the RIC via:

- the following methods: ensuring a moral and material remuneration for authors of innovative solutions; creation of a competence enhancement system; creation of innovation-oriented project structures; development of a set of organizational and economic tools related to decision making;
- the following mechanisms: fostering an innovation-focused culture; development of a system of communicative interactions among participants in innovation processes; appraising employee performance; creation of a mentorship system; project management.



## Conclusions

The choice of specific methods and mechanisms for ensuring influence on RICs on the part of entities in segments within the innovations market must, above all, be based on the advisability of ensuring the intensive assimilation of the results of innovation activity among all RIC partners. In practice, a model for managing innovation-driven development within RIC must make it possible to ensure the priority of innovative activity as a key form of economic activity within the RIC, which, in turn, should help to radically change the nature of innovation activity within the RIC in the direction of ensuring economic growth, speeding up scientific-technical progress, and boosting the competitiveness of innovative products and services within the RIC. As a result, innovation activity within the RIC will develop mainly within the frame of areas conducive to boosts in the level of infrastructural development within the RIC and to improvements in the quality of work and in the level of labor productivity within regions' RIC. This will help reduce the degree to which domestic RICs are lagging behind similar industrial establishments in other countries.

## References:

- Akat'ev, V. P.; Alekseeva, M. B.; Savel'eva, S. B.; Koz'menko, S. Yu.; Bogachev, V. F.; Petko, O. V. 2009. *Formirovanie promyshlennykh klasterov v kontseptsii innovatsionnogo razvitiya regiona*: Monografiya [The formation of industrial clusters and the concept of innovation-driven development in a region: A monograph]. Saint Petersburg, Russia: INFO-DA.
- Aniskin, Iu. P.; Bulkanov, P. A.; Enikeeva, S. A.; Mitrokhin, D. I.; Nечepurenko, M. N. 2009. *Upravlenie korporativnymi izmeneniyami po kriteriyu ustoichivosti* [Managing corporate changes based on the sustainability criterion]. Moscow, Russia: Omega-L.
- Berg, D. B. 2000. Evolyutsionnye modeli rosta v usloviyakh ogranichennykh resursov [Evolutionary models of growth in a climate of scarce resources]. In L. I. Abalkin (Ed.), *Evolutsionnaya ekonomika i meinstrim* (Doklady i vystupleniya uchastnikov mezhdunarodnogo simpoziuma, g. Pushchino, 29 maya 1 iyunya 1998 g.) [An evolutionary economy and the mainstream (Presentations and speeches by participants in an international symposium, Pushchino, May 29 – June 1, 1998)]. Moscow, Russia: Nauka.
- Goncharenko, O.; Tohochynskyi, O.; Sirenko, K.; Chebonenko, S.; Tretiak, H. 2019. Innovative performance as precondition of sustainable and secure development, *Journal of Security and Sustainability Issues* 8(3): 531-544. [https://doi.org/10.9770/jssi.2019.8.3\(19\)](https://doi.org/10.9770/jssi.2019.8.3(19))
- Iasin, E. G. 2009. *Modernizatsiya Rossii* [Modernization of Russia]. Moscow, Russia: GU VShE.
- Ignatavičius, R.; Tvaronavičienė, M.; Piccinetti, L. 2015. Sustainable development through technology transfer networks: case of Lithuania, *Journal of Security and Sustainability Issues* 4(3): 261-267. [http://dx.doi.org/10.9770/jssi.2015.4.3\(6\)](http://dx.doi.org/10.9770/jssi.2015.4.3(6)) SCOPUS
- Kleiner, G. B. 2002. *Strategiya razvitiya predprinimatel'stva v real'nom sektore ekonomiki* [Strategy for fostering entrepreneurship in the real sector of the economy]. Moscow, Russia: Nauka.
- Likhachev, V. A. 2017. *International technology transfer: main trends and Russia's position*. Rossiyskiy Vneshneekonomicheskiy Vestnik, 10: 29-43.
- Lvov, D. S.; Sorokin, D. E. 2005. *Rossiya v globaliziruyushchemsya mire: Strategiya konkurentosposobnosti* [Russia in a globalizing world: Strategy for competitiveness]. Moscow, Russia: Nauka.
- Milner, B. Z. 2010. *Innovatsionnoe razvitie: Ekonomika, intellektual'nye resursy, upravlenie znaniyami*: Monografiya [Innovation-driven development: Economics, intellectual resources, knowledge management: A monograph]. Moscow, Russia: INFRA-M.
- Monni, S.; Palumbo, F.; Tvaronavičienė, M. 2017. Cluster performance: an attempt to evaluate the Lithuanian case, *Entrepreneurship and Sustainability Issues* 5(1): 43-57. [http://doi.org/10.9770/jesi.2017.5.1\(4\)](http://doi.org/10.9770/jesi.2017.5.1(4))
- Petrenko, Y.; Vechkinzova, E.; Antonov, V. 2019. Transition from the industrial clusters to the smart specialization of the regions in Kazakhstan, *Insights into Regional Development* 1(2): 118-128. [https://doi.org/10.9770/ird.2019.1.2\(3\)](https://doi.org/10.9770/ird.2019.1.2(3))



*Platzhnyi balans Rossiiskoi Federatsii za 2016 g.* [Russia's balance of payments for 2016]. n.d. Retrieved from [https://www.cbr.ru/vfs/statistics/credit\\_statistics/bop/bop\\_np-mc\\_2016.xlsx](https://www.cbr.ru/vfs/statistics/credit_statistics/bop/bop_np-mc_2016.xlsx)

Popkov, D. V.; Kotsiubinskii, V. A. 2017. Proizvodstvo vysokotekhnologichnoi produktsii grazhdanskogo naznacheniya v OPK Rossii do 2030 g. [Production of high-tech civil use output within Russia's military-industrial complex through to 2030]. *Innovatsii*, 8, 10–16.

Razminienė, K.; Tvaronavičienė, M. 2017. Economic globalization and its impacts on clustering, *Terra Economicus*, 15 (2): 109-121 <http://doi.org/10.23683/2073-6606-2017-15-2-109-121clustering.html>

Sapir, E. V.; Blinova, T. S. 2009. *Innovatsionnoe razvitie ekonomiki: Sushchnost', strategii, izmerenie*: Monografiya [Innovation-driven development of the economy: Essence, strategy, measurement: A monograph]. Yaroslavl, Russia: Yaroslavskii Gosudarstvennyi Universitet.

Shevtsov, P. A. 2011. *Chelovecheskii potentsial kak osnovnoi faktor innovatsionnogo razvitiya ekonomiki (statisticheskii aspekt)*: Monografiya [Human potential as a key factor for the innovation-driven development of the economy (The statistical aspect): A monograph]. Moscow, Russia: Izdatel'stvo RGTEU.

Tvaronavičienė, M.; Razminienė K. 2017. Towards competitive regional development through clusters: approaches to their performance evaluation, *Journal of Competitiveness*, 9(4): 133 - 147, <https://doi.org/10.7441/joc.2017.04.09>

Tvaronavičienė, M. 2017. Clusters, innovations and energy efficiency: if relationship could be traced, *Marketing and Management of Innovations* 2: 382 - 391 <http://doi.org/10.21272/mmi.2017.2-35>

Tvaronavičienė, M.; Černevičiūtė, J. 2015. Technology transfer phenomenon and its impact on sustainable development, *Journal of Security and Sustainability Issues* 5(1): 87–97. [http://dx.doi.org/10.9770/jssi.2015.5.1\(7\)](http://dx.doi.org/10.9770/jssi.2015.5.1(7))

Valter, N.; Androniceanu, A.; Dragulanescu, I.V.; Duca, M. Agile management based on modularization of products and processes, Proceedings of BASIQ International Conference – New Trends in Sustainable Business and Consumption, 2-3 June, 2016, Konstanz, Germany, Book series: Proceedings of BASIQ, pp: 310-318, Edited by: Rodica Pamfilie, Vasile Dinu, Laurențiu Tăchiciu, Doru Pleșea, Cristinel Vasiliu; ISSN 2457-483X.

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## TOWARDS THE INNOVATION-FOCUSED INDUSTRY DEVELOPMENT IN A CLIMATE OF DIGITALIZATION: THE CASE OF RUSSIA

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**Abstract.** Aims: the purpose of this paper is to determine, based on an analysis of innovation processes within industry, some of the key issues in and priorities for the management of the technological development of the national economy through the example of Russia. Results: the paper identifies some of the key trends in and characteristics of the development of Russia's industrial complex and the potential for integrating it into the world economic system using the tools of marketing. The authors prove that in today's realities it is advisable to develop appropriate organizational-economic forms of entrepreneurship to stimulate innovation activity. The paper identifies some of the key factors influencing investment processes in machinery manufacturing (workforce qualifications, production volume, dynamics of demand for the sector's output, level of innovation activity within the sector, etc.). Conclusions: the paper identifies a set of key marketing tools for stimulating innovation processes within the industrial complex in a climate of the development of a digital economy in Russia by reference to different phases in the lifecycle of the innovation process. The authors identify the key focus of innovation activity, which is a focus on the creation of network added value. The paper brings forward a client-oriented model of expanded innovation process based on the building of technological chains by industrial companies.

**Keywords:** industrial complex; technological development; tools of marketing; digital economy; technological platforms

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**JEL Classification:** O1, O3

## 1. Introduction

The industrial complex, which has been the backbone of the economy in most developed and developing nations, performs a variety of functions, including economic, financial, scientific-technological, political, and social. At the same time, in the post-industrial economy the significance of industry is gradually declining. Yet, in Russia and in a number of other developing economies its role is, actually, augmenting. The significance of the industrial complex is determined by its special role in providing employment to able-bodied citizens, ensuring decent standards of living for the population, and overcoming the cyclical nature of the economy. Therefore, it is really important to ensure its sustainable operation, which ought to be based on advanced technological and innovation-driven development.

Russia's experience in managing the technological development of industry is specific due to a number of objective and subjective factors, like its historically emphasized industrial production (which it has maintained since the Soviet period), its developed fuel-and-energy complex, its qualified workforce, etc. Exploring of this experience contribute to understanding of regional development peculiarities.

The Russian economy and its principal sphere, industry, are currently faced with a number of tough issues. The nation's industrial production is under stiff pressure on the part of the external and internal markets, which have been implementing a number of restrictive measures. Notwithstanding that the introduction of these restrictive measures is caused by different factors (political, economic, etc.), the development of many sectors within the nation's industry has been impeded. Economic sanctions have been having quite a substantial negative effect on the operation of companies that are at the forefront of industry in Russia.

Under these conditions, the Russian economy and its backbone, industry, may require a change of strategy and an orientation toward the maximum use of internal potential based on boosts in industrial production with a focus on innovation and the use of digital technology. To boost innovation activity at industrial business entities, it may help to make a keener use of the tools of marketing.

This study's theoretical and methodological bases are grounded in works by scholars focused on innovation-driven development in companies, marketing, and instrumental-methodological solutions by research teams at research institutes and design organizations (Morrar, Arman, & Mousa, 2017; Pfohl, Yahsi, & Kurnaz, 2015; Qin, Liu, & Grosvenor, 2016; Anderson & Wladawsky-Berger, 2016; European Commission, 2014; Eddelani, El Idrissi & Monni, 2019; Zeibote, Volkova & Todorov, 2019; Tkachenko, Kwilinski, Korystin, Svyrydiuk & Tkachenko, 2019; Goncharenko, Tohochynskyi, Sirenko, Chebonenko & Tretiak, 2019; Goncharenko, Tohochynskyi, Sirenko, Chebonenko, & Tretiak, 2019; Zemlickiene, Mačiulis & Tvaronavičienė, 2017; Tvaronavičienė, 2017; Tvaronavičienė & Razminienė, 2017; Androniceanu & Krajčík, 2017; Razminienė & Tvaronavičienė, 2018; Petrenko, Vechkinzova, & Antonov, 2019). Managing the technological development of industry using the tools of marketing is a decidedly effective mechanism for driving economic development which is used in many countries around the world. In addition, the implementation of various technologies for digitalizing the economy enables those nations to achieve more effective interaction among the government, business, and society.

## 2. Methods

To analyze and assess technological development within Russia's industry, the authors employed methods of economic-statistical research. Based on data from Rosstat and using ratio and statistical analysis, the authors explored the dynamics of key indicators of industrial development within the Russian economy. The dynamical method helped identify a set of key stages in technological development within industry, including some of the key trends in change in labor productivity.

Using comparative analysis, the authors identified some of the key strengths and weaknesses of industrial development in Russia. Correlation analysis helped identify a set of key factors influencing the dynamics of investment processes in machinery manufacturing. Qualitative analysis helped identify the most effective tools of marketing for managing technological development in industrial companies by reference to different phases in the lifecycle of the innovation process.

### 3. Results

Reorienting Russia's economic system from its traditional model of development to an innovation-focused one is viewed by scholars and practitioners as a key strategic area for the nation's development. Otherwise, the Russian economy may simply end up left long out of the world's scientific-technological progress, one of its key manifestations being Industry 4.0. The key strands of Industry 4.0 implemented in the industrial complex include the following: creating network establishments and integrating them across the entire value chain; building a global wide-band infrastructure comprised of global networks that are in a high-level relationship between each other; ensuring the safety of production; organizing labor at "smart" enterprises; ensuring education and advanced training; having in place a sound regulatory framework; ensuring the efficiency of use of resources (Lenchuk & Vlaskin, 2010; Ministry of Education and Science of the Russian Federation, 2009).

Internal factors governing Russia's economic development have yet to facilitate the fulfillment of its industrial-production and technological potential. In the global technological market, structural transformations have been implemented along the line of ascending complexification, with a focus on tapping into new markets for high-tech products. By contrast, in the last decade of the 20th century and in the early 21st century Russia followed a descending line of primitivization of production and copying of outdated industrial units that were in the late stages of the lifecycle.

Despite the fact that Russia's industry has a multiparadigm technological base and features production operations from the fifth and sixth paradigms, there is a need to overcome the nation's technological lags in the real sector of the economy. The findings from the authors' analysis indicate that, on the whole, in machinery manufacturing and machine-tool building Russia is currently trailing behind the rest of the world by between 1.5 and 2 technological generations, i.e. nearly 20–30 years considering that one generation is 10–15 years long.

The implications of the above-mentioned kind of restrictive measures, present or future, for economic growth in industry's top sectors and for the nation's GDP dynamics have been quite significant, having in consideration the effects of the economic crisis of 2014. In the period 2012–2016, the average annual rate of decline in the Russian economy was 0.2%, with quite a substantial role played in this regard by economic sanctions, which has only exacerbated the negative trend (Novikov, 2015; Rosstat, n.d.). When it comes to industrial production, there is, however, one positive consideration that is worth mentioning. Industry's sectors are adapting to negative consequences from the restrictive measures faster than the nation's economy, taken as a whole, is. More specifically, compared with 2015, when the nation's slump across all sectors of the economy totaled 2.8%, in 2016, despite the general downward trend that persisted, industry exhibited an increase of 1.1% in indices of the physical volume of production, including an increase of 0.1% in manufacturing. Labor productivity is a major indicator that reflects the level of technological development of industrial production. Table 1 illustrates the dynamics of labor productivity within the key sectors of Russian industry in the period 2006–2016 (Rosstat, n.d.).

**Table 1.** Index of Labor Productivity across Key Sectors within the Russian Economy for the Period 2006–2016 (% relative to the previous year)

Indicators	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Overall across the economy	107.5	107.5	104.8	95.9	103.2	103.8	103.3	102.2	100.7	97.8	99.8
Extraction of mineral resources	103.3	103.1	100.9	108.5	104.3	102.7	100.3	100.8	102.8	98.4	98.3
Manufacturing	108.5	108.4	102.6	95.9	105.2	105.6	104.8	102.2	102.5	96.9	100.8
Production and distribution of power, gas, and water	101.9	97.5	102.1	96.3	103.0	99.8	100.2	99.1	100.2	99.9	102.1

On the whole, labor productivity in Russia was two times lower in 2016 than in the OECD member states. In 2015, productivity in Russia was down for the first time in six years (a drop of 2.2%). In 2016, labor productivity in the manufacturing industry rose by 0.8%, which is not enough for a shift from the lower to the upper path of technological development and may lead to the technological degradation of most industrial production operations.

Russia's technological development, as a key imperative for the nation, deals with the development of not just technology but markets as well. Interaction between the two processes may be facilitated by the use of the tools of marketing, which can help equilibrate demand and supply in the market for innovative products. The findings from the authors' factor analysis indicate that the greatest effect on the dynamics of investment in machinery manufacturing comes from the quality of manpower, the volume of production, the level demand for the product, and the level of innovation activity. Hence, the nation can hardly achieve economic growth on an innovative basis without implementing the marketing of innovations and making a keen use of marketing tools.

In today's climate of market transformations and an orientation toward the consumer, the marketing of innovations is the most significant tool of management, which links together and coordinates the operation of all functional units within a company based on a corporate strategy developed. It is aimed at the fulfillment of functions such as those related to determining consumers' informed preferences with respect to the innovative product, conducting integrated research into the market and economic conditions around industrial production, planning the consumptive qualities of an innovative product based on the preferences identified, working out and implementing a marketing plan for promoting the innovation, monitoring the efficiency of marketing activities, and adjusting the marketing plan by reference to the deviations detected.

Today, some of the key issues in the management of the marketing of innovations in Russia include:

- over 20% of high-ranking managers concerned with marketing at industrial companies do not have the practical skills required to implement it in the area of innovation;
- nearly 20% of companies have a shortage of qualified marketeers;
- nearly 10% of companies have no experience in commercializing technology (Stančík, 2007; Sekerin, Avramenko, Veselovsky, & Aleksakhina, 2014).

An effective innovative marketing mix incorporates such key elements as product and product policy, price and performance (productivity), sales channels, and promotion. Quite significant is the role of the tools of marketing in minimizing commercial risks around innovative products via testing, including conceptual testing, test marketing, and other types of tests, which may boost the likelihood of successful commercialization of novel solutions.

The average expenditure on the marketing of innovative products in domestic companies does not exceed 10–15% of their total expenditure on innovation activity, which is not enough to ensure the effective commercialization of novel solutions. In addition, the share of organizations that are engaged in marketing innovation does not exceed

1.5% in Russia. Industrial companies prioritize technological innovation, which is followed in significance by organizational innovation, with marketing-related innovation bringing up the rear.

The cause behind the insufficient implementation of the marketing of innovations in the activity of industrial companies in Russia is the predominant use of outdated mechanisms for the management of innovation processes. The senior management of innovation-focused companies is focused primarily on the useful features of an innovation, then on looking for sources of funding, and only lastly on identifying potential sales markets and analyzing their capacity.

Thus, there is a contradiction between what innovation-focused organizations do and what end consumers of innovative products, actually, expect. A possible solution to this issue is using intermediaries in conducting innovation activity and developing new organizational-economic forms of entrepreneurship – centers for the commercialization of technology and technological platforms.

## Discussion

In the leading nations of Europe and Asia, a key factor in industrial development is the generation of world-class technological innovations. It is from this standpoint that investing in fixed assets is implemented. In Russia, the situation is a bit different. The findings from the authors' correlation analysis helped identify some of the most significant factors influencing the dynamics of investment in machinery manufacturing, which are provided in Table 2.

**Table 2.** An Assessment of the Effect of Key Economic Factors on the Dynamics of Investment in Russia's Machinery Manufacturing in the Period 2006–2016

	Economic factors	Correlation coefficient	Strength of the relationship
1	Workforce qualifications	0.90	Direct strong
2	Production volume dynamics	0.88	Direct strong
3	Dynamics of demand for the sector's output	0.82	Direct strong
4	Level of innovation activity of companies within the sector	0.77	Direct strong
5	Profitability of economic activity	0.54	Direct tangible

Thus, of the greatest significance is the level of workforce qualifications, with high figures posted by production volume dynamics and the dynamics of demand for the product as well. The level of innovation activity in the sector is ranked 4th, meaning that this factor is less significant in Russia than in economically developed countries.

Depending on which phase in the lifecycle of the innovation process it is, it is possible to differentiate between strategies for investing at the early and final stages of the innovation-investment process. Industrial companies that pursue the first type of strategy have innovation business units which not only carry out the company's primary activity but conduct R&D as well. These companies possess significant resource and innovation potential, are distinguished by high investment attractiveness, and are viewed as pioneers and leaders in their sector.

Strategies for investing in the final stages of the innovation-investment process are normally implemented by industrial companies by way of process or product simulation and technological transfer of already existing innovative early majority solutions, which they tend to adapt to the conditions of their own economic system having in consideration the marketing niche they occupy and their established groups of consumers. This type of innovative strategies is practiced in their activity by followers and the late majority.



In addition to factors that most influence technological development, Russia's industry has another distinctive characteristic – the insignificant role of the tools of marketing in promoting innovative products and cutting-edge production technology. To stimulate demand for innovative products turned out by industrial companies and ensure a predominant orientation toward the generation of world-class technological innovations, the pursuit of the two above-mentioned innovation-investment strategies may need to involve the use of various tools of marketing, like those listed in Table 3.

**Table 3.** A Classification of Marketing Tools Employed in Implementing Various Types of Innovation-Investment Strategies in Industrial Companies

	Tools of marketing	Types of innovation-investment strategies	
		Initial stages in the innovation-investment process	Final stages in the innovation-investment process
1	Tools for motivating investors to invest in industry	Setting up special agencies that will work with potential investors; investment guides	Catalogues of innovation-investment projects; special websites on innovation projects
2	Tools for cultivating innovation potential	Putting together and getting to developers "selling information" indicators in the form of a roster of its "selling aspects", which shape consumers' competencies and informed needs; developing fundamental functionalities using nontechnological innovations (e.g., marketing and organizational)	Forming a team of performers of fundamental functions at the enterprise; building up intellectual potential; managing cross-functional interactions; developing fundamental functionalities using technological innovations
3	Tools for minimizing innovation-investment risks	Conducting assessments and monitoring of innovation risks; working out appropriate measures for forestalling and countering risks across all stages in the innovation process	Conducting assessments of risks to business activity; working out appropriate measures for forestalling and countering risks across all stages in the innovation process
4	Tools for managing the efficiency of an innovation project	Providing support for the project up until it is paid off; developing appropriate methods for assessing the efficiency of a project from a standpoint of increase in shareholder added value	Developing appropriate methods for assessing the efficiency of a project from a standpoint of increase in shareholder added value
5	Tools of the digital economy	Fostering a culture of information security among staff and corporate units concerned with information security; introducing digitalized document flow	Putting together aggregated information on the current condition of the company's external and internal environment in a format that is common to all the subsystems; introducing digitalized document flow

*Source:* authors

Thus, based on the product's commercial viability, functionality employed in the innovation process may be viewed as fulfilled only after the innovation is perceived by the mass end consumer. Consequently, when the innovation is brought out into the marketplace, it is necessary to ensure an aggregate result for all of the five groups of marketing tools for stimulating innovative activity in industrial companies (PwC, 2017; Sölvell, Lindqvist, & Ketels, 2003).

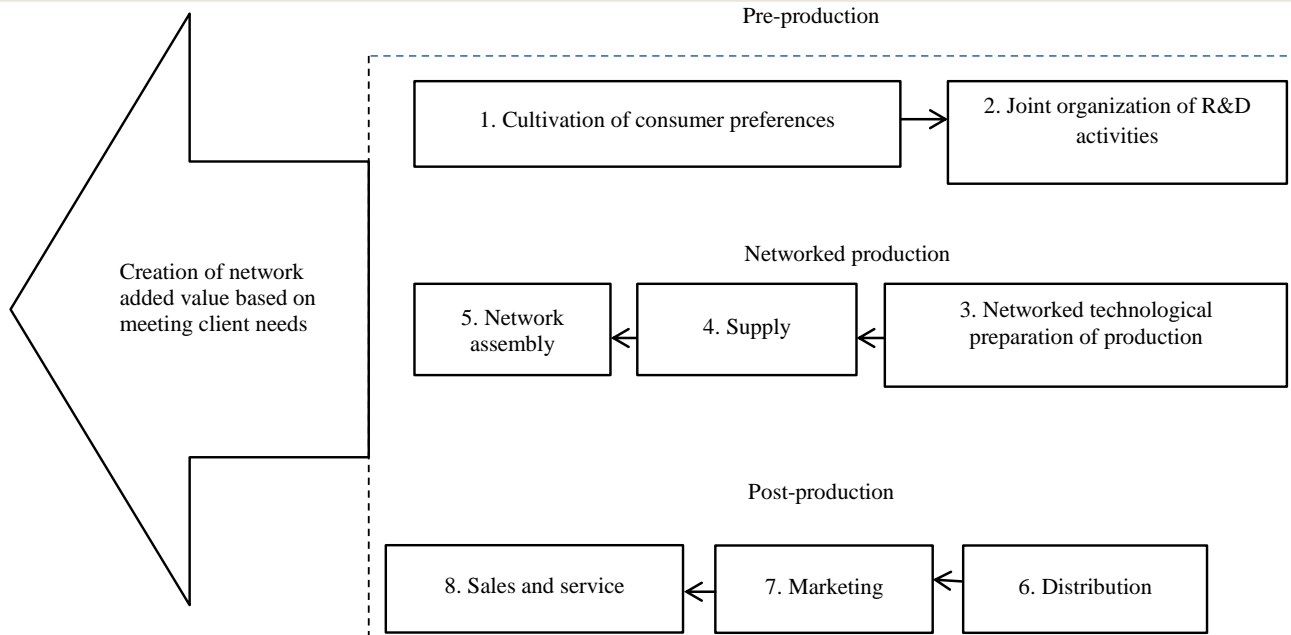
Unfortunately, the share of projects that have been implemented in industrial production among the most significant investment projects which are to be implemented in Russia in the period through to 2025 is insignificant. A few noteworthy examples include the construction of a polymer production plant in Samara Oblast, a steel and pipe production plant in Belgorod Oblast, the Zvezda ship-building complex in Primorsky Krai, the Tayshet Aluminum Plant in Irkutsk Oblast, and a few others (Expert RA, 2018; TekhUspekhi Top-15 Rankings in 2016, n.d.). In today's climate of the major significance of factors of demand, there is relevance in employing a client-oriented model of expanded innovation process. Based on this kind of model, in terms of

boosting the likelihood of successful commercialization of innovations, the function of marketing is, above all, oriented toward the fashioning of consumers' preferences and informed needs. The concept of a client-oriented expanded innovation process ought to be implemented using a systemic approach and prior to the commencement of the R&D stage (in the phases of establishment and getting an innovation into the market). It implies close integration with the consumer of innovations at all stages in managing the lifecycle.

In the early phases of the lifecycle, of the greatest significance in a client-oriented model are indicators of "selling information" in the form of a roster of its "selling" qualitative and quantitative characteristics which shape consumers' competencies and informed needs. In the late phases, the function of marketing is reoriented toward extending the innovation's lifecycle. As a result of the use of the 4P complex of marketing activities, there is transmitted from the consumer, by way of two-way communication, information based on which a decision is made regarding either the technical modernization of the innovative product or its scientific-technological enhancement (R&D) (Buckley, Clegg, & Wang, 2007; Gnezdova, Kugelev, Romanova, & Romanova, 2016; Australian Trade and Investment Commission, 2010).

In addition, utilizing the tools of the digital economy opens for companies exciting vistas in terms of boosts in efficiency in the area of managing their technological development, namely: (1) enhancing the management of production reserves (45–50% of the total magnitude of the economic effect); (2) extending equipment's lifecycle (10–15%); boosting equipment's technical availability (10–15%); (3) optimizing after-sales service (4–10%); (4) boosting labor productivity (1.5–5%); (5) enhancing R&D and production (1.5–5%). Thus, the joint use of digital technology and marketing tools leads to a synergy effect in industrial production (Veselovsky, Abrashkin, Aleksakhina, & Pogodina, 2015; Veselovsky, Gnezdova, Menshikova, Izmailova, & Romanova, 2015).

A key role in assessing the efficiency of for-profit companies ought to be played by analyses of the rate of increase in economic added value, and in the case of stock companies – in shareholder added value, following the implementation of an innovation project. This stance is based on that it is added value that reflects in full measure the attractiveness of a project from the perspective of a value-oriented approach and helps ensure boosts in the quality of decisions made which are oriented toward the achievement of strategic objectives on the industrial company's development. In recent years, the world economy has been dominated by processes that are related to the integration of efforts by various companies aimed at turning out radically innovative products. This interaction is taking place based on the pursuit of an innovation-investment strategy of building technological chains. A client-oriented model of expanded innovation process based on the building of technological chains by industrial companies is illustrated in Figure 1.



**Fig. 1.** A client-oriented model of expanded innovation process based on the building of technological chains by industrial companies

In Russia, a strategy of building technological chains is quite keenly employed by certain industrial companies operating within the metallurgy and machinery manufacturing sectors. However, there is a growing need for implementing this strategy on a systematic basis, which may require the development of special organizational-economic forms of entrepreneurship, like technological platforms. A key purpose behind the use of a technological platform is to optimize expenditure on the development of innovations and eliminate the gaps among science, society, and production.

In essence, a technological platform is a platform where all interested economic entities can get together and discuss relevant major areas for the development of a specific sector of the economy, all the way to working out a common strategy for development. Technological platforms make it possible to assess the competitiveness of a potential innovative product and determine the level of demand for it. Russia is making a keen use of best practices from European nations on creating technological platforms. In 2012, an official decision by the Presidium of the Government Commission on High Technology and Innovation put a stamp of approval on 30 technological platforms representing various areas, like medicine and biotechnology (3 units), information-communications technology (2), photonics (2), aerospace technology (3), nuclear and radiation technology (3), power generation (4), transportation technology (2), technology related to metallurgy and new materials (2), extraction of mineral resources and oil refinement (3), electronics and machinery manufacturing (3), and environmental development (3).

Despite being in operation formally, a major portion of technological platforms appear not to be living up to their full potential at this time. Still, there are a number of positive examples, like the performance of technological platforms such as Meditsina Budushchego ('medicine of the future'), BioTekh 2030 ('BioTech 2030'), and Fotonika ('photonics'). These platforms are not only focused on network interaction inside Russia but are oriented toward international cooperation as well, which enables them to be among the leaders in the world economy. Among the technological platforms which are quite active at the moment are Bioenergetika ('bioenergy'), Ekologicheski Chistaya Teplovaya Energetika Vysokoi Effektivnosti ('high-efficiency ecologically clean thermal power'), Perspektivnye Tekhnologii Vozobnovlyaemoi Energetiki ('promising renewable energy technology'), Malaya Raspredeleonnaya Energetika ('small-scale distributed power generation'), Materialy i Tekhnologii

Metallurgii ('metallurgy materials and technology'), and Glubokaya Pererabotka Uglevodorodnykh Resursov ('advanced processing of hydrocarbon resources'). This is testimony that technological platforms are developing quite actively within the industrial sector of Russia's economy. However, it may help to amplify their activity in the direction of boosting the innovation and marketing potential of industrial companies that are part of a technological platform. This kind of integration of activities by industrial companies within the framework of a technological platform should help create network added value based on working out a common strategy for the development and implementation of joint R&D activities.

Considering that the technological development of the Russian economy is hardly possible without the use of relevant marketing tools at the federal and regional levels, it may be advisable to conduct marketing research by way of technological platforms, which could help facilitate boosts in the commercial efficiency and implementation rate of innovation projects. A key purpose of the tools of marketing in this context is creating a favorable environment for the efficient operation of high-tech production operations within the Russian economy via the implementation of horizontal and vertical integration and optimization of business processes in industrial companies.

### **Conclusions**

The findings from the authors' analysis indicate that the potential for and efficiency of innovation activity in industrial companies are largely determined by the level of their innovation and marketing potential. Therefore, to be able to make appropriate changes to the structure of their output and boost their innovation component, companies need to, above all, focus on ramping up their innovation and marketing potential.

The key areas for enhancing the strategic approach to managing an industrial company that is oriented toward an innovation-focused path of development include the following:

- identifying a "key link" in the enterprise's production-business process and focusing on it a major portion of the company's managerial efforts;
- expanding the sphere of application and use of new methods for analyzing activity;
- implementing a system of managing the innovation processes based on deviations;
- forecasting in the early stages the potential for and the degree of risk of negative trends emerging in the event certain production-business indicators fall below the established limits;
- making active use of the tools of marketing to stimulate innovation activity by reference to the type of innovation-investment strategy implemented by the industrial company;
- being orienting toward maximizing economic (shareholder) added value, as a criterion for the efficiency of implementation of innovation projects and an innovation strategy in industrial companies as a whole;
- ensuring systemicity in the operation of the company's production and functional units with a focus on the targeted orientation of their activity toward the effectuation of long-term plans on innovation-investment development.

### **References:**

Androniceanu, A.; Krajčík, V. 2017. *Integrated performance management system in a globalized organization*. Conference: Finance and performance of firms in science, education and practice, 26-27 April, 2017, Zlin, Czech Republic, Proceedings of the 8th International Scientific Conference Finance and Performance of Firms in Science, pp. 30-43. ISBN 978-80-7454-653-2.

Anderson, L.; & Wladawsky-Berger, I. 2016. The 4 things it takes to succeed in the digital economy. <https://hbr.org/2016/03/the-4-things-it-takes-to-succeed-in-the-digital-economy>

Australian Trade and Investment Commission. 2010. Market Snapshot – China. Qualified Domestic Institutional Investors (QDII). [http://docshare.tips/china-market-snapshot-qdii\\_574e0e9fb6d87f411f8b5fab.html](http://docshare.tips/china-market-snapshot-qdii_574e0e9fb6d87f411f8b5fab.html)

Buckley, P. J.; Clegg, L. J.; & Wang, C. 2007. Is the relationship between inward FDI and spillover effects linear? An empirical examination of the case of China. *Journal of International Business Studies*, 38(3): 447–459.

Eddelani, O.; El Idrissi, N. E.; Monni, S. 2019. Territorialized forms of production in Morocco: provisional assessment for an own model in gestation, *Insights into Regional Development* 1(1): 6-18. [https://doi.org/10.9770/ird.2019.1.1\(1\)](https://doi.org/10.9770/ird.2019.1.1(1))

European Commission. 2014. Expert Group on Taxation of the Digital Economy. Working paper: Digital economy – facts & figures. [https://ec.europa.eu/taxation\\_customs/sites/taxation/files/resources/documents/taxation/gen\\_info/good\\_governance\\_matters/digital/2014-03-13\\_fact\\_figures.pdf](https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/gen_info/good_governance_matters/digital/2014-03-13_fact_figures.pdf)

Expert RA. 2018. *Krupneishie kompanii Rossii, realizuyushchie innovatsionnye proekty* [Russia's largest companies engaged in the implementation of innovation projects]. <https://raexpert.ru/researches/expert-inno/part5/>

Gnezdova, J. V.; Kugelev, I. M.; Romanova, I. N.; & Romanova, J. A. 2016. Conceptual model of the territorial manufacturing cooperative system use in Russia. *Journal of Internet Banking and Commerce*, 4(21): 82–87.

Goncharenko, O.; Tohochynskyi, O.; Sirenko, K.; Chebonenko, S.; Tretiak, H. 2019. Innovative performance as precondition of sustainable and secure development, *Journal of Security and Sustainability Issues* 8(3): 531-544. [https://doi.org/10.9770/jssi.2019.8.3\(19\)](https://doi.org/10.9770/jssi.2019.8.3(19))

Lenchuk, E. B.; Vlaskin, G. A. 2010. Klasternyi podkhod v strategii innovatsionnogo razvitiya zarubezhnykh stran [The use of a cluster-based approach as part of a strategy of innovation-driven development in foreign countries]. *Problemy Prognozirovaniya*, 5; 38–51.

Ministry of Education and Science of the Russian Federation. 2009. Natsional'naya innovatsionnaya sistema i gosudarstvennaya innovatsionnaya politika Rossiiskoi Federatsii. Bazovyi doklad k obzoru OESR natsional'noi innovatsionnoi sistemy Rossiiskoi Federatsii [The National Innovation System of the Russian Federation and Russia's Government policy on innovation. A fundamental report on the OECD's survey of the National Innovation System of the Russian Federation]. [www.csr-nw.ru/files/csr/file\\_content\\_174.pdf](http://www.csr-nw.ru/files/csr/file_content_174.pdf)

Morrar, R.; Arman, H.; Mousa, S. 2017. The fourth industrial revolution (Industry 4.0): A social innovation perspective. *Technology Innovation Management Review*, 7(11): 12–20. [https://timreview.ca/sites/default/files/article\\_PDF/Morrar\\_et\\_al\\_TIMReview\\_November2017.pdf](https://timreview.ca/sites/default/files/article_PDF/Morrar_et_al_TIMReview_November2017.pdf)

Novikov, A. 2015. Osobennosti IR-praktiki rossiiskogo emitenta v Kitae i drugikh stranakh [Characteristics of IR practices by Russian securities issuers in China and other countries]. *Vestnik NP ARFI*, 13: 51–61.

Petrenko, Y.; Vechkinzova, E.; Antonov, V. 2019. Transition from the industrial clusters to the smart specialization of the regions in Kazakhstan, *Insights into Regional Development* 1(2): 118-128. [https://doi.org/10.9770/ird.2019.1.2\(3\)](https://doi.org/10.9770/ird.2019.1.2(3))

Pfohl, H.-C.; Yahsi, B.; & Kurnaz, T. 2015. The impact of Industry 4.0 on the supply chain. In W. Kersten, T. Blecker, & C. M. Ringle (Eds.), *Innovations and strategies for logistics and supply chains*, 31. Hamburg, Germany: Epubli.

PwC. 2017. Money Tree. Navigator venchurnogo rynka. Obzor rynka venchurnoi industrii Rossii za 2016 god [MoneyTree™: Venture Market Navigator. The 2016 survey of Russia's venture capital industry]. <http://www.rvc.ru/upload/iblock/905/money-tree-rus-2016.pdf>

Qin, J.; Liu, Y.; & Grosvenor, R. 2016. A categorical framework of manufacturing for Industry 4.0 and beyond. *Procedia CIRP*, 52: 173–178.

Razminienė, K., Tvaronavičienė, M. 2018. Towards clusters' performance evaluation: the system of indicators. 10th International Scientific Conference “Business and Management 2018” May 3–4, 2018, Vilnius, Lithuania Section: Contemporary Issues in Economics Engineering <http://www.bm.vgtu.lt> ISSN 2029-4441/eISSN 2029-929X ISBN 978-609-476-119-5 eISBN 978-609-476-118-8 <https://doi.org/10.3846/bm.2018.06>

Rosstat. (n.d.). Rossiiskii statisticheskii ezhegodnik [Russian statistics yearbook]. [http://www.gks.ru/wps/wcm/connect/rosstat\\_main/rosstat/ru/statistics/publications/catalog/doc\\_1135087342078](http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1135087342078)

Sekerin, V. D.; Avramenko, S. A.; Veselovsky, M. Y.; & Aleksakhina, V. G. 2014. B2G market: The essence and statistical analysis. *World Applied Sciences Journal*, 31(6): 1104–1108.

Sölvell, Ö.; Lindqvist, G.; & Ketels, C. 2003. *The Cluster Initiative Greenbook*. Stockholm, Sweden: Bromma tryck AB.

Stančík, J. 2007. *Horizontal and vertical FDI spillovers*: Recent evidence from the Czech Republic. <https://cerge-ei.cz/pdf/wp/Wp340.pdf>

Tkachenko, V.; Kwilinski, A.; Korystin, O.; Syrydiuk, N.; Tkachenko, I. 2019. Assessment of information technologies influence on financial security of economy, *Journal of Security and Sustainability Issues* 8(3): 375-385. [https://doi.org/10.9770/jssi.2019.8.3\(7\)](https://doi.org/10.9770/jssi.2019.8.3(7))

Top 15 reitinga “TekhUspek” – 2016 [TekhUspek Top-15 Rankings in 2016]. (n.d.). <http://www.ratingtechup.ru/rate/2016/>

Tvaronavičienė, M., Razminienė K. 2017. Towards competitive regional development through clusters: approaches to their performance evaluation, *Journal of Competitiveness*, 9(4): 133 - 147, <https://doi.org/10.7441/joc.2017.04.09>

Tvaronavičienė, M. 2017. Clusters, innovations and energy efficiency: if relationship could be traced, *Marketing and Management of Innovations* 2: 382 - 391 <http://doi.org/10.21272/mmi.2017.2-35>

Veselovsky, M. Y.; Abrashkin, M. S.; Aleksakhina, V. G.; & Pogodina, T. V. 2015. Features of state regulation of the economy in terms of its transition to innovative way of development. *Asian Social Science*, 11(1): 288–296.

Veselovsky, M. Y.; Gnezdova, J. V.; Menshikova, M. A.; Izmailova, M. A.; & Romanova, J. A. 2015. Mechanism of use of public and private partnership in order to develop innovative economy. *Journal of Applied Economic Sciences*, 10(5): 625–634.

Zeibote, Z.; Volkova, T.; Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development* 1(1): 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))

Zemlickiene, V.; Mačiulis, A.; Tvaronavičienė, M. 2017. Factors impacting the commercial potential of technologies: expert approach, *Technological and Economic Development of Economy*, 23(2): 410-427 <http://dx.doi.org/10.3846/20294913.2016.1271061>

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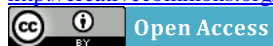
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## A COMPLIANCE COST ANALYSIS OF THE SECA REGULATION IN THE BALTIC SEA<sup>\*</sup>

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**Abstract.** This paper measures and analyses the cost of sulphur emission control area (SECA) regulations that came into effect on the 1st of January 2015 in the BSR. Given the upcoming 2020 global sulphur directive, the role of the SECA regulatory costs analysis is vital in shaping global compliance. The specific measure of regulatory costs used the data of ship traffic in the BSR and their fuel consumption before and after the SECA implementation to estimate the change in shipping costs in the SECA area. The result indicates high costs, but not overly significant or negative as was predicted before the enforcement primarily because of the reduced cost of maritime fuel

**Keywords:** SECA Regulation; Costs of Regulation, Clean Shipping, Sustainability, Global sulphur cap

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## **1 Conceptual Foundation and Premises**

Regulations compliance do not come cheap. There are costs attached to them, but policymakers pursue the implementation of regulations on the premise that the benefits would far outweigh the costs (Atkinson & Mourato, 2008). However, whether the outcomes are worth the costs remain a cause of disagreement among scholar up until now (Pray et al., 2005). Worldwide, governments try to analyse the economic implications of the regulatory decision and even though the OECD (2005) study shows that regulations have a minimal economic impact, the tendency of lawmakers to have an idea of the impact of their regulation has not reduced. Other broad sets of research have suggested that sometimes, regulations promote healthy competition in the industries that are related to such regulations (Demirguc-Kunt et al., 2003).

This study, in particular, focuses on the costs related to the International Maritime Organisation (IMO) adoption of an integrated approach in response to the growing environmental challenges to solving the issue of atmospheric sulphur pollution from shipping activities. The Sulphur regulation is in two-fold. The first was directed to the creation of the sulphur emissions control area (SECA) that prohibits shipowners to use fuel with sulphur content higher than 0.1% while the second is the global sulphur limit that pegs the sulphur content in marine fuel to 3.5% and 0.5% from 2020 in non-SECA areas (IMO, 2008;2013;2016).

Specifically, because they are often very strict, environmental regulations always generate controversial debates and arguments especially on their negative influence on economic growth (Benshalom, 2006). However, Porter & van der Linde (1995) explained that strict environmental policies would have an overall positive impact on any industry or sector in the end because they stimulate efficiency that would compensate the costs of the regulation and nurture innovation in new technologies. Lähteenmäki-Uutela et al. (2019) tested this hypothesis on the SECA regulation and found it to be true. Some industrial sectors even start to think of how to turn green and sustainable solutions in their business into a competitive advantage (Hunke & Prause, 2014). Despite this, regulations imply that the actors within that industry spend much revenue in their responses to regulations (Rugman & Verbeke, 1998). Some of the supporting highlights of this summary are that strong environmental regulations increase production costs, increase waste disposal dilemma and reduce capital flow (Hahn, 1998). On an economic point of view, industries are often localised in countries or environment with less stringent laws and low production costs (Beaton et al., 1995; Sunding, 1996).

With a contrary opinion, Lee (2017) reasoned that environmental regulations are supposed to support economic growth in addition to protecting the environment. However, designing a clear, comprehensible and well-organised regulation is a huge challenge, which is why policymakers follow up on the implementation, the appropriateness and the relevance of regulations. There is other literature supporting that environmental regulations do not make a significant economic impact. Xing & Kolstad (2002) said that the overall regulatory implementation costs could be small and neglectable. In other words, the positive impact of the regulations creates a balance between their costs and their benefits. Although there is no definitive blueprint to enforcing any regulations; ultimately, the critical effort is making them work for the stakeholders (Cole & Elliott, 2003).

Further, while other contradictory views put a direct negative relationship between strict regulations and economic factors like price, profit, foreign direct investment and others, consistent with previous studies, Olaniyi, Prause & Boyesen (2018a) explained that environmental regulation is not the only variable that affects the economy.

Therefore, as concluded by List & Co (2000) & Chung (2014), FDI might not have a significant or direct implication on the economy or the industry implied so it may not be true that regulations affect FDI or capital movement.

However, as shall be seen later in this work, environmental regulations such as the SECA involve dangerous financial undertakings relating to new and improved technologies, engines and factories upgrade suggesting that its implementation may influence production costs directly. For example, the SECA regulation has witnessed several compliance activities that have to do with installing abatement technologies like the scrubbers in close to a 100 ships in the BSR, engine upgrades needed to switch from high Sulphur fuel oil or fuel needed for engine flush to use the low sulphur fuel. In some cases, there has been a complete change of engines for the use of alternative fuel. While in respect to technological development for a region, the numbers may not look impressive but at least 7-9% of the ships plying the BSR water have had one form of abatement technology installed on board or have had a complete change of their engine to enable the use of alternative source of energy to run their ship (Olaniyi et al., 2018b). These activities affect production one-way or another, they either change the production cost or transfer them and whichever way, changes are made.

There are also discussions about how trade influences delivery of economic growth that focuses on whether improved economy can be attributed to local activities or not, it probes if actual growth can occur because of different types of investment that would stem from regulations that have more stringent effects on economic growth rate (Martin & Sunley, 1998). Likewise, business owners in the maritime sector were afraid that it could negatively affect the spatial distribution of the industries in the BSR and subsequently international trade flow. This issue was also intensively discussed when the SECA law was enacted; there were many debates on the potential impact on the competitiveness of the maritime companies within the BSR (EfficienSea2, 2016). It was speculated that the increase in costs could lead to the relocation of affected companies. Hämäläinen (2015) forecasted that paper machine and mill closures should be expected in Finland due to the SECA directive because global paper companies would react to the cost challenge by relocating their bulk paper production to the periphery closer to markets. There were also prediction of a possible cost increase for container shipping on the Asia-North Europe trade lane (an industrial sector sensitive to maritime transport costs) would range between 1.2% and 3.6%, however, OECD/ITF, (2016) reported an increase that did not exceed 0.5% in 2015 which have been stable over the years.

For the benefits of sulphur regulations to outweigh the costs, it will heavily rely on what reduction measure is being chosen by the stakeholders (Jiang et al., 2014). Fortunately, the SECA regulation is reported to have brought about significant emissions reductions (Johansson & Jalkanen, 2016; Lähteenmäki-Uutela et al., 2019a). In early research done in Denmark to measure air pollution in three monitoring areas to determine the sulphur oxide (SO<sub>2</sub>) concentration in the air, SO<sub>2</sub> concentration had dropped to 47% during January- May 2015 compared to 60% which has been the average concentration during the same months in 2011-2014 (OECD/ITF, 2016). The port of Gothenburg also showed a significant decrease of 80% since the introduction of the 0.1% SO<sub>2</sub> emissions requirement in 2015. The same was seen at port-city of Hamburg and in about 4,000 tests conducted in the middle of the BSR Sea between 2016 and 2017 there was close to about 95% emissions compliance rate and about 85% compliance around the borders (Olaniyi, 2017).

The BSR ports also experienced changes due to the SECA regulations that first made it compulsory for ships berthing in the EU seaports longer than 2 hours to switch their primary engine fuel to marine gas oil (MGO) or marine diesel oil (MDO). Although this rule had its consequences for the ports in that many shipping lines schedules were reorganised at the bid to reduce their time of staying in the ports (Nugraha, 2009). A situation that has dramatically reduced in the BSR and would further reduce after the 0.5% 2020 global sulphur limit rule implementation.

When the SECA regulation was enforced in 2015, there was vigorous debate on the negative impact it would have on the maritime business environment. There were many speculations, simulations, and predictions. Because of the

upcoming 2020 global sulphur directive, the role of the SECA regulatory costs analysis is essential in shaping global compliance. Moreso, for the sake of other future legislative programs, it is crucial that policymakers have a clear view of the cost implications of the implementation of the SECA regulation on the environment and the business sector of the maritime sector. Thus, the authors focus on the costs of SECA regulation as exemplified by the BSR experience in this study.

It is almost four years of SECA, and the questions still linger; how have we fared? How expensive has the compliance been? To remove scepticism concerning costs, it is critical for stakeholders (especially the shipowners who are the direct target of the regulation), policymakers, and other regulators to have some idea of the costs and impacts of the regulation. Having this information will help them make better decisions about how the current system could be made more efficient, which new regulations should be implemented, and how much to invest in enforcement of regulations.

Curiously, while many reports have countered the previous adverse reports and predictions, up until now there are still no real time numbers regarding SECA regulatory costs, what we have available are only the ex-ante numbers. The study tackles this issue through a cost analysis of the SECA regulation for the BSR. Using the data of ship traffic in the BSR and their fuel consumption before and after the SECA implementation, the authors estimated the change in shipping costs and together with the previously calculated administrative burden, calculated the total cost for the SECA regulation in BSR. The authors desire that this study can serve as a benchmark for an efficient future regulatory system.

The remainder of this article is divided into four sections. The first describes regulatory impacts and how they are mapped. The second discusses the methodology of the study, and the third expands on the findings and the analysis. The last section provides the conclusion.

## **2 Charting the SECA Regulatory Impacts**

Even though maritime transport is far less regulated than land-bound transport, there are still specific apprehensions commonly voiced with the costs that arise from regulatory compliance because they could run into millions of euros (Gollop & Roberts, 1983). This situation is also actual of shipping regulations whose implication on the activities of the maritime sector stakeholders are directly or indirectly linked to the economic decision that will ensue in their efforts to comply. Most authorities start regulatory projects believing that the investments are economically justified, i.e. the benefits to society supersede the costs (Renda, 2017).

For SECA, the choice for compliance had depended on the time the ship spends within the SECA, the vessels fuel consumption and the price level of the low sulphur content fuels. For ships that operate less than 4,500 hours annually in SECAs, fuel switching became the lowest cost option (Carr & Corbett, 2015). In their efforts to reduce the compliance costs, the European Commission also put forward a set of measures to support the promotion of innovations for new abatement technologies (IMO, 2013). For abatement options, the spread between marine gas oil and heavy fuel oil determines the efficiency of a compliance option. In the case of a scrubber installation, this means that when the spread between MGO and HFO is considerably high, a shipowner would consider the abatement option since the scrubber investment yields a higher net present value than the use of MGO (Jiang et al., 2014; Atari et al., 2019).

Since investments, choices have a significant effect on a company or even a cluster; wrong investment decision can cause adverse setbacks and warrant years of recovery (Benetto et al., 2014). Strategic actions for regulatory compliance is thus very crucial (Demil & Lecocq, 2010). This dilemma forced the shipowners and ports to look for innovative ways to evaluate the financial attractiveness of their options for sulphur reduction and at the same time stay afloat profit wise (Wiśnicki et al., 2014). Their predicament of investment choices and sudden market changes

lead to intensive capital investments and increased operational costs associated with new and changed personnel, materials purchased, legal costs, paperwork.

For sustainability and effectiveness, enforcement of the SECA regulation is critical. The targeted SO<sub>x</sub> emission reductions will only be a dream if regulation is not enforced. This can disrupt shipping markets especially if ship owners see that that regulation is slacked, they can become complacent if they believe there is little or risk them if they are not compliant and put those who obey the regulation at a disadvantage over those who do not. Hence, the need for a level play especially when the cost to comply is put into consideration (OECD/ITF 2016). In order to ensure sustainable compliance, the government must take the responsibility of creating a balance between the regulations and their implementation through the measurement of the costs and benefits done to reduce the open loop and areas of financial wastage.

One of the approved methodologies used for the assessment of regulatory costs is based on Renda et al. (2013). In their work, they started with mapping out areas of regulatory impact, which they first classify as direct and indirect costs. Direct costs can be further classified into compliance costs and hassles costs that are linked to waiting time, delays, corruption that are difficult to identify, quantify, or monetise.

The compliance costs are categorised into regulation charges, substantive compliance costs, and administrative burden. Regulation charges are costs such as taxes, levies and other related fees. Substantive compliance costs are the total sum of three types of cost (i.e. capital, operational and financial). Capital costs (CAPEX), occurs when it requires acquisitions or upgrades of physical assets such as property, industrial buildings or equipment. Operational and maintenance cost (OPEX) represent variable costs that appear in the form of annual expenditures for wages, energy, materials and supplies, purchased services, and maintenance of equipment. Financial costs are investment merge for OPEX, which is an ongoing cost for running a product, business, or system whenever a new legal provision changes the structure of the working capital (OECD, 2005).

Administrative burdens are costs incurred whenever a company is confronted by the necessity to provide information that arises by the operation of law such as the SECA, which include costs that are obvious and can be objectively measured (e.g., the cost of work, material, services such as bookkeeping and so on). In other words, administrative burdens are the part of costs that businesses sustain because they are a regulatory requirement. This information is irrelevant regarding an activity that a business is required to perform because of a regulatory information obligation if the business would also perform such acts in the absence of such obligation, i.e. administrative activities that the businesses will continue to conduct if the regulations were removed (Olaniyi & Prause 2019). For example, the SECA administrative burden related to shipowners have to do with recording into bunker delivery notes (BDN); time spent recording (fuel sample, scrubber emissions logbook, fuel switchover before entering SECA, waste disposal logbook). Others are training and awareness of staff (also include hiring), off hiring days, i.e. installations and maintenance, time to write applications for subsidies, grant and loans related to SECA investments and other specified obligations. They can be little fragments of activities that are not only time consuming because of their repetitive nature but can also be costly if care is not taken.

A complete regulatory cost analysis should consider all kind of opportunity costs related to compliance, i.e. in the case of SECA regulation the additional fuel costs for SECA compliant fuels as well as the costs for abatement investments in case of using non-compliant fuels, since these costs that would be absent in the absence of the regulation. In the context of green and environmental issues, these costs are also known as “incremental cost” that does not involve the cost of business as usual (GCF 2018). These costs are calculated on the bases what type of cost they are, i.e. administrative, compliance costs, non-financial costs, directly or indirectly spent and frequency of costs (i.e. one-off or recurring). In the case of SECA, the price difference between the high sulphur fuel oil (HFO) and the SECA compliant fuel is the opportunity cost related to compliance. The same goes with the time spent on ship retrofit otherwise know as the off-hiring days”.

Indirect costs are changes in markets or experiences of end-users, government agencies or other stakeholders who are not directly related to the regulation calculated based on transferred costs to the consumer. It is also a type of cost that is transferred to the end users. In short, indirect costs are incurred when the regulation modifies or alters the market structure usually due to several reasons (Pray et al., 2005). An example of an indirect cost is the installation of a telephone line in a company, which may be needed to set up an enquiry line but because the telephone is also used for other purposes, the cost of connection is not added to the cost of regulations but is included in the overall overheads (Winter & May 2001). Bringing this to the SECA regulation and shipping, it could mean the need to buy a new ship because a shipowner wants to expand his business, but because of the SECA regulation compliance, decides to build the new ship with an LNG engine. Since the shipowner would still build a ship regardless of SECA for his expansion, the cost of the newly built ship is not included as a direct cost, but the difference between the cost of installing a regular engine and the LNG engine becomes the direct cost and is deducted as such.

### 3 SECA Regulatory Costs Analysis

Regulatory costs are more evident and measurable when concentrated on a particular group of stakeholder that are associated with regulation (Deringer, 2014). In earlier work, Olaniyi et al. (2017) categorised maritime stakeholders to which extent the SECA regulations and the analysis impact them showed that the shipowners are the most affected followed by the ports and port authorities. The least affected are the least public authorities and ministries, and one does not need to wonder why little or no work has focused on them since the inception of the law. This study is dedicated to the cost of SECA that relates to the ship owners.

The SECA related cost analysis for the BSR takes into account the data of ship traffic in BSR as well as the maritime fuel consumption. HELCOM, the Helsinki Commission monitors environmental and safety-related aspects of BSR shipping and publishes the results periodically. This research uses two relevant references from HELCOM, namely the estimations of shipping emissions for the year 2015 that are based on over 1.65 billion AIS-messages of about 8,000 IMO registered commercial ships as well as the HELCOM report on maritime activities in BSR. Mainwhile, Johansson and Jalkanen (2016) calculated ships emissions and their total maritime consumption for 2015 in the BSR based on the AIS position data using the Ship Traffic Emission Assessment Model (STEAM) of Jalkanen et al. (2009;2012;2016) and Johansson et al. (2013). The HELCOM (2018) report on maritime activities in BSR further delivered an overview of daily maritime traffic in Baltic Sea as well as an overview on the different types of ships plying in BSR yielding the study central two key figures:

1. The average number of daily plying ships on BS: ca. 1500 ships
2. Total fuel consumption for shipping in BSR: ca. 5 million tons

The two HELCOM reports also allocated the consumed maritime fuel to the different ship types. With this data, it becomes easy to know which compliance method ships in BSR are applying, especially the number of scrubbers and LNG installation. Thus, the research methodology extrapolates the maritime fuel consumption to the later years. It splits up the daily plying ships on BSR into those that were using the SECA compliant fuel like MDO/MGO before 2015, those that switched from high Sulphur fuel oil (HFO) to (ultra) low sulphur fuel (ULSFO) and those that used abatement investments like scrubbers or LNG. Consequently, the additional SECA-related costs are calculated by multiplying the number of ships proportionally distributed according to their method of compliance (to evaluate their fuel consumption) by the specific compliance costs per fuel ton and ship.

#### *Costing Model and Assumptions*

The estimation of additional fuel costs related to SECA regulations requires the determination of several parameters. It is first essential to know the description of fuel use before SECA, i.e. fuel use in the year 2014 and before, and



the situation from 2015 after SECA implementation. There were already ships, which were using the low sulphur fuel and did not have to invest after SECA. Thus, only the ships that had to switch from HFO to low Sulphur fuel or ships that had installed one form of abatement technology from 2015 incurred additional SECA costs. Putting it differently, the additional costs due to SECA implementation is calculated by comparing the situation before SECA, i.e. 2014, before, and after SECA, i.e. from 2015 to determine the number of ships that used SECA compliant fuel MGO or Diesel before SECA. All other ships that switched from HFO to other cleaner fuels or that installed abatement technology had to accept additional costs due to SECA.

The Helsinki Commission (HELCOM) latest published reports gained from the AIS data of ship traffic on Baltic Sea on maritime activities, HELCOM (2018) revealed that around 8000 IMO registered ships visit the BSR annually and about 1500 of those ships ply the BSR daily. Nearly half of these ships are cargo vessels, ca. 20% are tankers, and the rest are passenger ships, ferries, container ships and other vessels. Olaniyi, Atari & Prause (2018b) investigated the current abatement devices on BSR ships so that HELCOM table of the daily plying ship is shown in table 1:

**Table 1:** Distribution of BSR ships according to SECA compliance Method

Ship type	Percentage	#daily plying	#Scrubber	#LNG	#SECA fuel
Cargo	48%	720	8		712
Tanker	22%	330	1	2	327
RoRo & RoPax	8,5%	128	69	16	43
Service	5,2%	78			78
Container	4,3%	65	5		60
Fishing	4,1%	62			62
Others	7,4%	117			117
<b>Sum</b>	<b>100%</b>	<b>1,500</b>	<b>83</b>	<b>18</b>	<b>1,399</b>

Source: Adapted from HELCOM (2018)

Then, according to Jalkanen et al. (2016), the 1500 ships that daily travel on daily travel on the Baltic sea consumed about 5 million tons of maritime fuel in 2015. Using the detailed HELCOM (2016) view of fuel consumption by ship type, the maritime fuel consumption according to the daily plying ships on the Baltic Sea was evaluated. Already, the fuel study of Trafikanalys (2016) for the Baltic Sea after SECA had calculated the total consumed maritime diesel/gas oil percentage in BSR in 2014 to be about 20%, a result comparable with another maritime fuel mix from other studies (i.e. Concawe 2016; IEA 2017). In addition to that, expert interviews confirmed that outside SECA areas or without SECA regulations, shipowners had always used MDO/MGO, in general, to complement HFO for special purposes but not to propel exclusively commercial vessels. The reasons have been that the HFO has special physical properties that make it necessary to complement its use with diesel (Stopford 2016). Thus, the results indicated that there were no remarkable changes in the number of a number of the daily plying ships on the Baltic Sea after eliminating MDO and MGO from the annual maritime fuel consumption in BSR shown in table 2.

**Table 2:** Annual maritime fuel consumption in BSR (2015)

Million fuel tons	2015 fuel	2015 Diesel	2015 Scrubber	2015 LNG	2015 SECA fuel
Cargo	0.869	0.174	0.008	0.000	0.687
Tanker	1.094	0.219	0.003	0.005	0.867
RoRo & RoPax	1.472	0.294	0.635	0.147	0.396
Service	0.040	0.008	0.000	0.000	0.032
Container	0.758	0.152	0.047	0.000	0.560
Fishing	0.048	0.010	0.000	0.000	0.038
Others	0.692	0.138	0.000	0.000	0.554
<b>Sum</b>	<b>4.973</b>	<b>0.995</b>	<b>0.692</b>	<b>0.153</b>	<b>3.134</b>

Source: Adapted from HELCOM (2016)

The consumed fuel per tons in 2015 is proportionally distributed based on the number of daily plying ships and their choice of SECA compliance. For example, in the case of cargo vessels that are equipped with the scrubber, it is assumed that 8 of these scrubber vessels consumed “8/720” of the non-diesel fuel tons in 2015. This action gave the distribution of the consumed fuel tons according to the ships’ compliance methods whether Diesel/MGO, scrubber, LNG or ultra-low sulphur fuel oil (ULSFO) that we name in the table as well as in the sequel as SECA fuel. Due to the neglectable number of other modes of SECA compliance method, table 2 depicts a fair representation of the maritime fuel situation in 2015.

Next, after identifying the ships and the distribution of the different maritime fuels or abatement technologies used, it becomes possible to evaluate the additional costs of SECA compliance. The consumed MDO and MGO fuel before SECA is first is assumed to be zero (0 €) per ton since there are was no fuel switch. Therefore, no additional costs for SECA compliance can be recorded in this regard. For the HFO users using the scrubber technology, the study used the results of Olaniyi et al. (2019) that calculated the average additional costs for scrubbing per one ton of HFO with ca. 37€ per. In a comparable approach, BPO (2017) estimated the additional costs of using LNG to propel ships to ca. 41€ per ton to open the option to evaluate the volume of consumed fuel switch from HFO to low Sulphur fuel fuels.

As might have been expected, the evaluation of fuel switch to low sulphur fuel is linked to a couple of issues. The first is to decide the type of HFO under consideration since HFO has different viscosities with prices. The second is related to the type of the SECA-compliant fuel used from 2015 since also there are different options of low Sulphur fuel (i.e. ULSFO, MGO or MDO), which also have different prices. Unfortunately, a peep into public statistics regarding the distribution of consumed fuels does not lead to satisfying results for the BSR, so the authors decided to carry out expert interviews to obtain reliable results realised from Tallinn and Rostock.

Interviews outcome showed that it is within the limit to assume that over 90% of used HFO represents IFO380 that also enjoys the lower price compared to the IFO180. Similarly, answers regarding the low sulphur fuel revealed that the preferred fuel is one with the lowest price, which is the ULSFO. Consequently, the additional costs of the switch from HFO to the SECA-compliant fuel (SECA fuel) are evaluated by the price spread between the HFO IFO380 and the ULSFO.

A spread calculation for the years from 2015 to 2018 is thus realised easily by calculating the average spread per ton that leads to the following figures (table 3) using the Rotterdam daily fuel prices (ECG 2019):

**Table 3:** Fuel price spread calculation between IFO380 and ULSFO/MGO (2015 – 2018)

Spread	2015	2016	2017	2018
Mean ULSFO-IFO380	186.26 €	150.43 €	151.92 €	182.83 €
StD ULSFO-IFO380	24.53 €	20.28 €	18.27 €	19.19 €
Mean MGO- IFO380	214.12 €	170.39 €	167.58 €	210.99 €
StD MGO-IFO380	23.62 €	20.20 €	19.84 €	19.38 €

Source: authors own calculation

Atari and Prause (2018) and Olaniyi et al. (2018) analysed the statistical properties of the maritime fuel spreads and were able to show that the spread is an underlying normal distribution, which makes it possible to calculate confidence intervals together with their characteristic error probabilities. However, as shall be seen later in the study, the authors consider only the spread between the ULSFO and IFO380 HFO since shipping is a price sensitive



business and the ships that used the HFO before 2015 are still able to operate with ULSFO, as most shipowners preferred the ULSFO compared to MGO due to lower price.

The next stage of the analysis deals with the issue of forecasting fuel consumption from 2015 into the following years. Here, one often-used approach is to extrapolate the increased maritime traffic from 2015 into the following years with fuel reductions from energy savings from new technologies (Kalli et al., 2013).

Finally, the consumed maritime fuel in 2015 was extrapolated to the following years by assuming an annual maritime traffic increase of 1.5% together with an annual increase energy efficiency of 2% within the whole BSR fleet according to Kalli et al. (2013). Thus, the 2016 total fuel consumption in BSR, as well as the fuel consumption of the following years, are forecasted (table 4) by taking the current annual fuel consumption in a million tons and multiplying it by  $1.015 * 0.98$ , i.e.  $4.947 = 4.973 * 1.015 * 0.98$ .

**Table 4:** Fuel consumption in the BSR (2015-2018)

Million tons	2015	2016	2017	2018
Fuel consumption	4.973	4.947	4.920	4.894
Annual Diesel part	0.995	0.989	0.984	0.979
Non-MGO/MDO fuel	3.978	3.957	3.936	3.915

Source: authors own calculations

The most critical data for the estimation of the total fuel cost for shipping in BSR is the MGO/MDO maritime fuel consumption estimated at 20% of the total fuel consumption. Further, because of the higher price for MGO/MDO compared to the ULSFO, this percentage is assumed to stay almost stable over the years (2015 – 2018).

## 4 Findings and Discussion

Based on the previous reflection it becomes possible to tackle the question of additional costs of SECA regulations from 2015 to achieve, the following figures (table 5):

**Table 5:** Additional costs in million € of SECA regulations in 2015

	2015 total fuel	2015 Diesel	2015 Scrubber	2015 LNG	2015 SECA fuel
Million tons in 2015	4.973	0.995	0.692	0.153	3.134
Add. Costs per ton		0.00 €	37.00 €	41.00 €	186.26 €
Million €		0.000	25.604	6.273	583.739

Source: authors own calculations

Hence, the calculation sums up to about 616 million € as total additional costs for SECA compliance in 2015. By dividing the additional compliance costs by the consumed fuel in BSR in 2015, the calculation also yields average additional compliance costs per ton of consumed fuel of about 124€ due to SECA regulation. With the same approach, the additional SECA compliance costs for 2016 – 2018 can be estimated which is done in table 6:

**Table 6:** Additional costs in millions € of SECA regulations (2015 – 2018)

	2015	2016	2017	2018
Fuel consumption per million ton	4.973	4.947	4.920	4.894
Non-MGO/MDO fuel	3.978	3.957	3.936	3.915
Mean ULS-IFO380 Spread (€)	186.26	150.43	151.92	182.83
Annual add. Fuel costs (million €)	615.616	500.641	502.608	563.940

Source: authors own calculations

By taking the average over the years 2015 – 2018, the calculation yields additional annual costs of SECA compliance to be about 550 million € for the BSR which equals to about 110 € additional costs per consumed fuel ton for shipping in BSR. As discussed earlier, following Atari & Prause (2018) study, the price spread of maritime fuel is assumed to be normally distributed, so it is possible to fix confidence intervals to determine the real additional costs from the study estimations with a given error probability.

Particularly for reliability, this result has to be compared to findings of other works done before the enforcement of SECA regulations in 2015. Kalli et al. (2013) estimated the additional SECA compliance costs to be between 400 – 700 million € per year and Johansson & Jalkanen (2016) also gave a more technical approach to the same study. These results are entirely in line with our research estimating the annual SECA compliance costs based on real costs from 2015 to 550 million € which represents precisely the middle of the confidence interval of Kalli et al. (2013). Our research also points out that the ex-ante predicted additional SECA compliance costs by renowned experts that ranged up to several billion EURO was by far too high and do not cope with the reality (Olaniyi & Prause 2019). The same argumentation applies to the before 2015 estimated annual additional SECA compliance costs between €5 and €30 billion by 2020 that seems not to be reasonable when comparing our results (Platts, 2016). By summing up all results, it turns out that the estimations of this research fits well to the already published forecasts and helps to correct unrealistic estimations by using real data from the first four years of SECA experience in the Baltic Sea Region.

In order to give a full picture concerning the additional SECA compliance costs another thing to be under consideration also the costs for the administrative burden of SECA regulations. These costs have been investigated by Olaniyi & Prause (2019) to an annual amount of about 2.9 million € for the BSR. Thus, by taking under account also these costs, the estimation gives total additional costs for SECA compliance of annually in table 7:

**Table 7:** Annual total additional costs of SECA compliance

Total annual average costs	Million €
Additional annual fuel costs	550
Annual administrative burden	2.96
<b>Sum</b>	<b>553</b>

*Source: authors' own calculations*

In 2014, the average HFO price showed a ton price of IFO380 in Rotterdam to be around 532€. However, with the enforcement of the SECA regulations in 2015, the majority of the HFO fueled ships in BSR could switch from HFO to ULSFO that has comparable properties with the HFO but is SECA-compliant. An analysis of the price range of ULSFO at Rotterdam between 2015 and 2018 showed an annual average price per ton of 450€ (2015), 364€ (2016), 456€ (2017) and 584€ (2018). It was at the middle of 2018 that the ULSFO prices reached and further partly exceeded the HFO price so that the nearly first four years of SECA implementation passed by with the ULSFO price below the maritime fuel prices before SECA. This development kept the maritime fuel costs below the price level in 2014 so that there was no need to increase maritime transportation price.

The future development of the oil price is, of course, open but currently, the fuel price still ranges around the 2014 annual average. This suggests that the shipping companies that avoided investments in abatement technologies could end up falling into a strategic trap of a further increase in oil prices and would not be able to keep up with their costs. This situation can force an increase in transport prices that can weaken their competitiveness in the maritime industry. On another hand, shipowners who had decided early to invest in SECA compliant abatement investments may enjoy increasing benefits due to higher margins from the opportunity to use cheaper HFO (Atari et al., 2019; Olaniyi et al., 2019).

Practically, regulations usually do not show promising economic outcomes or a balanced cost/benefit; however, policymakers proceeded with the implementation if end-result is somewhat “bearable for the actors (Hammitt, 2000). There has been evidence to show that regulatory costs are often overestimated in conservative ways. For example, in their study, Goodstein and Hodges (1997) saw that the costs of proposed regulations regarding asbestos, benzene, coke ovens, cotton dust, strip mining, and vinyl chloride were significantly overestimated (Hammitt, 2000), same attitude witnessed in the maritime industry at the implementation of the SECA regulations. A way to look at it is that the costs of regulations are often passed down to the end-users to forestall any loss the companies related might have, although this is not seen as a direct impact since they involve value, trade-offs but leaves the end users with less disposable income (Keeney, 1997).

Though maritime sceptics did not receive the SECA regulation with great enthusiasm, so far, the outcome has been impressive and a high level of compliance witnessed in the BSR (Lähteenmäki-Uutela et al., 2019a; b). As stated above, one reason for these observations can be attached to the decrease in the oil price from 2014 that lead to lower maritime fuel costs and lasted until 2018. Thus, the economic impact of the SECA regulation showed that there were less dramatic impacts than was predicted including possible modal shifts, changes in transport patterns and logistics pricing issues (Olaniyi et al., 2018a). Already at the begin of the EnviSuM project, Olaniyi (2017) highlighted that based on a survey among maritime stakeholders in BSR there is no evidence to show increased prices in BSR logistics sector, a result further confirmed by the statistical analysis of foreign trade flows and maritime transport by Wenske (2018). Besides, latest results on the estimation of the administrative burden by Olaniyi & Prause (2019) and a real option based evaluation of abatement technology investments by Atari et al. (2019) also showed a neglectable impact on the maritime industry. Notwithstanding, for a more profound cost-benefit analysis of the SECA regulations in BSR, these costs have to be paired into a relationship with the benefits. There are several benefits attached to the Sulphur regulations in the BSR, some of those include the increase of the air quality within BSR and the reduction of the annual emission of Sulphur into half. However, one benefit with the most consequence is the 1000 less premature deaths experienced due to cleaner air (Prause et al., 2019) and a push of blue growth innovation activities in BSR investigated by Lähteenmäki-Uutela et al. (2019a;b).

## 5 Concluding Remarks

This study attempted to provide the calculations on the costs of SECA regulation post-2015 enforcement. Despite some *a posteriori* estimations done before its implementation and shortly after, until now, the empirical study on the estimation of the total cost analysis for ship operators is missing. This paper fills this gap, and the underlying data in the related research were elaborated within an EU funded project EnviSuM - Environmental Impact of Low Emission Shipping: Measurements and Modelling Strategies.

Many extensions of the SECA results are readily apparent, as expected, regulations would always have a direct impact on all actors involved but more heavily on some than for others. This is why sometimes when regulations are designed to be general for all within the same industry; they impose burdens on a particular sector more than other as the case seen with the shipowners and other stakeholders within the same cluster. On the positive side, the SECA regulations seem to have created more innovative technological awareness among the shipowners since its enforcement.

It has been over three years after the SECA regulations implementation in the BSR, and a renew focus is on the 2020 global Sulphur limit, a law which affects a broader audience and culture than the SECA. The findings of this study surely have important policy implications in helping to provide and design effective future implementation strategies of regulatory instruments that ensure sustainability. Nevertheless, a question remains on whether there is a country-specific advantage in the cost of regulations although the BSR maritime sector have made much effort to control emissions issues, their regulations and their related costs.

## References:

- Atari, S. & Prause, G. 2018. Risk assessment of emission abatement technologies for clean shipping. In International Conference on Reliability and Statistics in Transportation and Communication (pp. 93-101). Springer, Cham. [https://doi.org/10.1007/978-3-319-74454-4\\_9](https://doi.org/10.1007/978-3-319-74454-4_9)
- Atari, S., Bakkar, Y., Olaniyi, E.O. & Prause, G. 2019. Real options analysis of abatement investments for sulphur emission control compliance, *Entrepreneurship and Sustainability Issues*, 6(3), 1062-1087, [https://doi.org/10.9770/jesi.2019.6.3\(1\)](https://doi.org/10.9770/jesi.2019.6.3(1))
- Atkinson, G., & Mourato, S. 2008. Environmental cost-benefit analysis. *Annual review of environment and resources*, 33, 317-344. <https://doi.org/10.1146/annurev.enviro.33.020107.112927>
- Beaton, S. P., Bishop, G. A., Zhang, Y., Ashbaugh, L. L., Lawson, D. R., & Stedman, D. H. 1995. On-road vehicle emissions: regulations, costs, and benefits. *Science*, 268(5213), 991-993. <https://www.jstor.org/stable/2888864>
- Bonetto, P.; Hofmann, B.; Prause, G. 2014. Rise and fall of the Lyon silk cluster: A case study about entrepreneurial sustainability. *Entrepreneurship and Sustainability Issues*, 2(1), 1-11. [https://doi.org/10.9770/jesi.2014.2.1\(1\)](https://doi.org/10.9770/jesi.2014.2.1(1))
- Benshalom, I. 2006. Sourcing the Unsourceable: The Cost Sharing Regulations and the Sourcing of Affiliated Intangible-Related Transactions. *Va. Tax Rev.*, 26, 631.
- BPO 2017. World LNG Report. [https://www.igu.org/sites/default/files/103419-World\\_IGU\\_Report\\_no%20crops.pdf](https://www.igu.org/sites/default/files/103419-World_IGU_Report_no%20crops.pdf).
- Carr, E. W., & Corbett, J. J. 2015. Ship compliance in emission control areas: technology costs and policy instruments. *Environmental science & technology*, 49(16), 9584-9591. <https://doi.org/10.1021/acs.est.5b02151>
- Cole, M. A., & Elliott, R. J. 2003. Do environmental regulations influence trade patterns? Testing old and new trade theories. *World Economy*, 26(8), 1163-1186. <http://dx.doi.org/10.1111/1467-9701.00567>
- Concawe 2016. Maritime fuel facts, Brussels. <https://www.marinefuels2020.com/member/concawe>
- Chung, S. 2014. Environmental regulation and foreign direct investment: Evidence from South Korea. *Journal of Development Economics*, 108, 222-236. <http://dx.doi.org/10.1016/j.jdeveco.2014.01.003>
- Dechezleprêtre, A., & Sato, M. 2017. The impacts of environmental regulations on competitiveness. *Review of Environmental Economics and Policy*, 11(2), 183-206. <https://doi.org/10.1093/reep/rex013>
- Demil, B. and Lecocq, X. (2010). Business model evolution: in search of dynamic consistency. *Long range planning*, 43(2), 227-246. <https://doi.org/10.1016/j.lrp.2010.02.004>
- Demirguc-Kunt, A., Laeven, L., & Levine, R. 2003. Regulations, market structure, institutions, and the cost of financial intermediation (No. w9890). National Bureau of Economic Research. <http://www.nber.org/papers/w9890>
- Deringer, H. 2014. Cost-benefit analyses in trade regulation: How to assess the health impacts of non-tariff measures?
- ECG 2019. Bunker prices. <http://ecgassociation.eu/Publications-Reports/General/Fuel-Prices/Bunker-Prices>.
- EfficienSea2 2016. Report on the available technologies and sensors that can be utilized in the new system and on business model on incentives for monitoring and enforcement. <http://efficiensea2.org/publications/>
- Gollop, F. M., & Roberts, M. J. 1983. Environmental regulations and productivity growth: The case of fossil-fueled electric power generation. *Journal of political Economy*, 91(4), 654-674. <https://www.jstor.org/stable/1831072>
- Goodstein, E., & Hodges, H. 1997. Polluted data: Overestimating environmental costs. *American Prospect*, (35), 64-64.
- GCF 2018. Incremental cost methodology: potential approaches for the Green Climate Fund, Green Climate Fund, GCF/B.19/34, Korea.
- Hahn, R. W. 1998. Policy watch: government analysis of the benefits and costs of regulation. *Journal of Economic Perspectives*, 12(4), 201-210. <https://www.jstor.org/stable/2646905>
- Hämäläinen, E. 2015. Estimated impacts of the sulphur directive on the Nordic industry. *European Transport Research Review* 7(8). <https://doi.org/10.1007/s12544-015-0158-4>
- Hammitt, J. K. 2000. Are the costs of proposed environmental regulations overestimated? Evidence from the CFC phase-out. *Environmental and resource Economics*, 16(3), 281-302. <https://doi.org/10.1023/A:1008352022368>

HELCOM 2018. Maritime Assessment 2018 - HELCOM Assessment on maritime activities in the Baltic Sea 2018", Baltic Sea Environment Proceedings No.152. Helsinki Commission, Helsinki. 253pp.

Hunke, K.; Prause, G. 2014. Sustainable supply chain management in German automotive industry: Experiences and success factors, Journal of Security and Sustainability Issues, 3(3), 15-22. [https://doi.org/10.9770/jssi.2014.3.3\(2\)](https://doi.org/10.9770/jssi.2014.3.3(2))

IEA 2017. Tracking Clean Energy Progress 2017, International Energy Agency, OECD/IEA, Paris. <https://www.iea.org/etp/tracking2017/>

IMO 2008. Revised MARPOL Annex VI: Regulations for the prevention of air pollution from ships and NOx technical code. London: IMO Marine Environmental Protection Committee (MEPC). [www.imo.org/en/.../Environment/PollutionPrevention/AirPollution/.../176\(58\).pdf](http://www.imo.org/en/.../Environment/PollutionPrevention/AirPollution/.../176(58).pdf)

IMO 2009. Second IMO GHG Study. 2009. London, UK, April 2009; Buhaug, Ø., Corbett, J.J., Endresen, Ø., Eyring, V., Faber, J., Hanayama, S., Lee, D.S., Lee, D., Lindstad, H., Markowska, A.Z., Mjelde, A., Nelissen, D., Nilsen, J., Pålsson, C., Winebrake, J.J., Wu, W., Yoshida, K.

IMO 2013. Sulphur oxides (SOx)—Regulation 14.

[http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-\(SOx\)-Regulation-14.aspx](http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-(SOx)-Regulation-14.aspx)

IMO 2016. IMO sets 2020 date for ships to comply with low sulphur fuel oil requirement. Press briefing release 28/10/2016. Retrieved November 30, 2016 from <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/MEPC-70-2020sulphur.aspx>

Jalkanen, J.-P., Brink, A., Kalli, J., Pettersson, H., Kukkonen, J. and Stipa, T. 2009. A modelling system for the exhaust emissions of marine traffic and its application to the Baltic Sea area. Atmospheric Chemistry and Physics, 9 (2009) 9209-9223. [www.atmos-chem-phys.net/9/9209/2009/](http://www.atmos-chem-phys.net/9/9209/2009/)

Jalkanen, J.P., Johansson, L., Kukkonen, J., Brink, A., Kalli, J., & Stipa, T. 2012. Extension of assessment model of ship traffic exhaust emissions for particulate matter and carbon monoxide. Atmospheric Chemistry and Physics, 12(2012) 2641-2659. <https://doi.org/10.5194/acp-12-2641-2012>

Jiang L., Kronbak J., Christensen L. P. 2014. The costs and benefits of sulphur reduction measures: Sulphur scrubbers versus marine gas oil. Transportation Research Part D, Vol. 28, pp. 19–27. <https://doi.org/10.5194/acp-12-2641-2012>

Johansson L. & Jalkanen J. P. 2016. Emissions from Baltic Sea shipping in 2015, Baltic Sea Environment Fact Sheet 2016, HELCOM, Helsinki. [www.helcom.fi/baltic-sea.../environment-fact-sheets/.../emissions-from-baltic-sea-ship](http://www.helcom.fi/baltic-sea.../environment-fact-sheets/.../emissions-from-baltic-sea-ship)

Johansson L., Jalkanen J.-P., Kalli J. & Kukkonen J. 2013. The evolution of shipping emissions and the costs of recent and forthcoming emission regulations in the northern European emission control area. Atmospheric Chemistry and Physics, 13(2013) 11375-11389. <https://doi.org/10.5194/acp-13-11375-2013>

Keeney, R. 1997. Estimating fatalities induced by the economic costs of regulations. Journal of Risk and Uncertainty, 14(1), 5-23. <https://doi.org/10.1023/A:1007754402585>

Kalli, J., Jalkanen, J.-P., Johansson, L. & Repka, S., 2013. Atmospheric emissions of European SECA shipping: long-term projections. WMU Journal of Maritime Affairs, 12(2), pp. 129-145. <https://doi.org/10.1007/s13437-013-0050-9>

Keskonna inspeksioon 2017. [www.kki.ee](http://www.kki.ee) , Tallinn.

Lähteenmäki-Uutela, A., Yliskylä-Peuralahti, J., Repka, S., & Mellqvist, J. 2019a. What explains SECA compliance: rational calculation or moral judgment? WMU Journal of Maritime Affairs, 1-18. <https://doi.org/10.1007/s13437-019-00163-1>

Lähteenmäki-Uutela, A.; Yliskylä-Peuralahti, J.; Olaniyi, E.; Haukioja, T.; Repka, S.; Prause, G.; De Andres Gonzalez, O. 2019b. The impacts of the sulphur emission regulation on the sulphur emission abatement innovation system in the Baltic Sea region. Clean Technologies and Environmental Policy, 1–14. <https://doi.org/10.1007/s10098-019-01684-2>

Lee, S. I. 2017. Improving Regulatory Governance Trends, Practices and the Way Forward. OECD Publishing. <https://doi.org/10.1787/9789264280366-en>

Martin, R. and Sunley, P. 1998. Slow convergence? The new endogenous growth theory and regional development. Economic geography, 74(3), 201-227. <https://doi.org/10.1111/j.1944-8287.1998.tb00113.x>

Nugraha, F. 2009. Effective implementation of emission control area towards cleaner shipping operations: focusing on sulphur oxides (SOx) emission reduction. World Maritime University Dissertations. 186.



OECD 2005. Network, Standard Cost Model. International standard cost model manual. Measuring and reducing administrative burdens for businesses.

OECD/ITF 2016. Reducing Sulphur Emissions from Ships: The Impact of International Regulation. <http://www.itf-oecd.org/reducing-sulphur-emissions-ships-impact-international-regulation>

Olaniyi, E. O. 2017. Towards EU 2020: An Outlook of SECA Regulations Implementation in the BSR. *Baltic Journal of European Studies*, 7 (2), 182–207. <https://doi.org/10.1515/bjes-2017-0016>

Olaniyi, E. O, Bakkar, Y. & Prause, G. 2019. Entrepreneurial Compliance Opportunities for Maritime Fuel Producers, *Entrepreneurship and Sustainability Issues* 6(4): 1550-1565. [https://doi.org/10.9770/jesi.2019.6.4\(1\)](https://doi.org/10.9770/jesi.2019.6.4(1))

Olaniyi, E. O., & Prause, G. 2019. SECA Regulatory Impact Assessment: Administrative Burden Costs in the Baltic Sea Region. *Transport and Telecommunication Journal*, 20(1), 62-73. <https://doi.org/10.2478/tjt-2019-0006>

Olaniyi, E., Prause, G. & Boyesen, J. 2018a. The impact of SECA regulations on clean shipping in the BSR. In: Ölçer, A, Kitada, O., Dalaklis, D., Ballini, F., (eds.) *Trends and Challenges in Maritime Energy Management* book series of WMU Studies in Maritime Affairs 6(1) <https://doi.org/10.1007/978-3-319-74576-3>

Olaniyi, E.O., Atari, S. & Prause, G. 2018b. Maritime energy contracting for clean shipping. *Transport and Telecommunication*, 19(1), 31–44. <https://doi.org/10.2478/tjt-2018-0004>

Platts Shipping special report 2016. The IMO's 2020 global cap. What a 2020 sulphur –constrained world means for shipping lines, refineries and bunker suppliers. <https://www.platts.com/...Platts.../IndustrySolutionPapers/SR-IMO-2020-Global-sulfur>

Prause, G.; Reinhold, K.; Jarvis, M.; Olaniyi, E.; Tint, P. 2019. The Socio-Economic Impact of Green Shipping: A Holistic View from the Baltic Sea Region. In: Kabashkin, I.; Yatskiv, I. (Ed.). *Reliability and Statistics in Transportation and Communication*. Berlin: Springer. [https://doi.org/10.1007/978-3-030-12450-2\\_59](https://doi.org/10.1007/978-3-030-12450-2_59)

Pray, C. E., Bengali, P., & Ramaswami, B. 2005. The cost of biosafety regulations: the Indian experience. *Quarterly Journal of International Agriculture*, 44(3), 267-290.

Renda, A. 2017. One-step forward, two steps back? The new US regulatory budgeting rules in light of the international experience. *Journal of Benefit-Cost Analysis*, 8(3), 291-304. <https://doi.org/10.1017/bca.2017.18>

Renda, A., Schrefler, L., Luchetta, G. and Zavatta, R. 2013. Assessing the Costs and Benefits of Regulation. Brüssel: Centre for European Policy Studies. Online erhältlich unter: [http://ec.europa.eu/smartregulation/impact/commission\\_guidelines/docs/131210\\_cba\\_study\\_sg\\_final](http://ec.europa.eu/smartregulation/impact/commission_guidelines/docs/131210_cba_study_sg_final)

Rugman, A. M., & Verbeke, A. 1998. Corporate strategies and environmental regulations: An organizing framework. *Strategic management journal*, 19(4), 363-375. <https://www.jstor.org/stable/3094073>

Stopford, M. 2016. *Maritime Economics*, 3rd edition, Routledge London and New York. 2016.

Sunding, D. L. 1996. Measuring the marginal cost of non-uniform environmental regulations. *American journal of Agricultural economics*, 78(4), 1098-1107. <https://www.jstor.org/stable/3094073>

Trafikanalys. 2016. Fuels in the Baltic Sea after SECA. The Swedish government agency for transport policy analysis. 2016:12, Stockholm. <https://www.trafa.se/en/public-transport-and-publicly-financed-travel/>

Wenske, C. 2018. Statistical analysis of foreign trade flows and maritime transport. Baltic Marine Consult Ltd. Rostock. EnviSum Project WP 5.2.

Xing, Y., & Kolstad, C. D. 2002. Do lax environmental regulations attract foreign investment? *Environmental and Resource Economics*, 21(1), 1-22. <https://doi.org/10.1023/A:1014537013353>

Winter, S. C., & May, P. J. 2001. Motivation for compliance with environmental regulations. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, 20(4), 675-698. <https://doi.org/10.1002/pam.1023>

Wiśnicki, B., Czermański, E., Drożdziejki, S., Matczak, M., Spangenberg, E. 2014. Sulphur Regulation–technology solutions and economic consequences for the Baltic Sea Region shipping market. In: Ernest Czermański (ed.) *Institute of Maritime Transport and Sea-borne Trade*, University of Gdańsk.



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## ON THE SUPRANATIONAL AND NATIONAL LEVEL OF GLOBAL VALUE CHAIN MANAGEMENT

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**Abstract.** It has been proven that the functioning of global value chains (GVCs) takes place by the agreement of various interests of the participating subjects. In determining the direction of fragmentation of production processes of multinational corporations (MNCs), of particular importance are comparative advantages of countries, which explains the constant reconfiguration of GVCs, including the tendency of reconsolidation and repatriation of their links into developed countries occurring in the last decade. It is substantiated that superstate and state assistance to GVCs, in the conditions of the transformation of global production in the XXI century, is beginning to play a prominent role, without, however, decreasing the importance of corporate (or inter-corporate) regulation of these processes. The existing model of global production fragmentation, while active at the beginning of the XXI century, will not necessarily remain adequately effective in 10-15 years. Considering this, and the fact that the functioning of production chains participated in by MNCs is based on inter-country differences that are constantly changing under the influence of scientific and technological progress, it can be stated that global production will continue to evolve, as will GVCs and the conditions of their functioning, which makes further research in this direction relevant.

**Keywords:** business-government relations; regulation and internationalization; institutions; global value chains; fragmentation of production, innovation development

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**JEL Classifications:** E60, F12, F23, O33

## 1. Introduction

The acceleration of globalization processes at the end of the XX century and at the beginning of the XXI century has led to significant changes in the international business environment, which have manifested in the growth of economic and financial interdependence of countries, regions, markets and companies. Intensive development of scientific and technological progress, which has a significant impact on the processes of internationalization and

integration in the context of modern division of labour; a change in the public consciousness that forms a new relation to economic activity as such and contributes to the formation of new stereotypes, models, and forms of relationships in international business processes; the fragmentation of global production, which qualitatively changes the nature of the functioning of the economic systems themselves, giving them new opportunities and generating new risks in conditions of structural transformation of the economy - these are the main effects of these processes. Due to further transformation of traditional forms of international division of labour, the intensity of exchange and the increasing mobility of factors of production becomes very prominent, manifesting itself through the spread of global value chains (GVCs).

The effectiveness of the formation and development of GVCs depends on the conditions in which these economic relations are implemented. It is the awareness of the need to form a single economic, legal, and information space for effective business activity that contributes to the formation of such an environment, the features of which are the strengthening of the role of national and supranational institutions and mechanisms in the management of GVCs and creating an appropriate method for coordinating interests, with a fundamentally new regulatory and dispute resolution system.

World practice shows that, in the context of growing fragmentation of global production, national economies are increasingly drawn into internationalized production segments, becoming their constituent parts and exercising influence on the entire set of GVC segments. The high growth rates of developing countries, especially in Asia, stimulate explosive growth in demand and, accordingly, international trade. This, in turn, confirms in practice the thesis of Michael Porter that "the competitiveness of a country is created not on external, but on domestic markets" (1980, p. 218). As a result, trade in finished goods and services has been growing at almost the same rate as trade in intermediate products in the last quarter of the twentieth century. In these conditions, the structure of the world economy gains the features of multi-levelness and interdependence, which, in the conditions of the permanently weak dynamics of economic development of the last decade, makes relevant the issues of preserving jobs, increasing the level of localization of national production at all stages of creating value and protecting the domestic market. Therefore, the need to determine the specifics of the management of GVCs from the position of the subjects of these interactions (states, multinational corporations etc.) becomes urgent.

## **2. Literature review**

The rapid development of GVCs in the last third of the twentieth century is the result of the spread of cross-border fragmentation (the transfer of production elements across national borders) between developed and developing countries. Moreover, the theoretical substantiation of these processes is the model of two-dimensional fragmentation of production, proposed in (Kimura & Ando, 2005). Meanwhile, since the middle of the twentieth century, the interest in studying these processes has been reflected in the theory of placement of production, which uses neoclassical economy as the theoretical basis. The main contribution to its development was made by representatives of the German Geographical School, namely Lösch (1940). The subsequent growth of interest in the issues of placement of production and the formation of the theory of GVCs has been contributed to by the work of one of the founders of the theory of information society, Castells (1996). Further, since the 1990s, representatives of institutional and evolutionary theories became more actively involved in the analysis of network forms. And it is precisely O. Williamson (1981) who has identified networks (or, in his terminology, hybrids) as a separate subject of research within the institutional analysis of organizational forms of conducting business. Miles and C. Snow (1995) have focused on the study of mechanisms for the use of collective resources. Van Elstein (1997) made a synthesis of different approaches to the study of network systems with further detailed study of their distinctive properties within different schools of economic analysis. Powell's and Smith-Dora's (2010) joint research, conducted within the framework of an evolutionary scientific direction, helped to identify the factors influencing the spread of production chains, and these factors became the basis for the classification of modern forms of inter-organizational cooperation.

The theoretical and methodological foundations of studying the functioning of a GVC are considered in the works of Arndt and Kierzkowski (2001), De Backer and Miroudot (2014), Gereffi and Wyman (2014), Stöckinger (2018),

Johnson and Noguera (2012), Drăgulănescu and Androniceanu (2017), Kimura and Lee (2006), Mazaraki (2018). Special attention should be paid to the scientific studies of the impact of national and regional innovation systems on the economic development of developing countries (see, for example, Arocena, & Sutz, 2000; Lundvall, et al, 2011; Pukala, 2016; Labunska et al, 2017; Zeibote et al., 2019). Also worth mentioning is the sectoral system approach (Malerba, & Nelson, 2011), as it gives an opportunity to understand how national and sectoral characteristics are related to foreign trade relations and how they influence the development of innovation and, accordingly, the functioning of GVCs.

Recent research in this area, e.g. of Dias Mora, Carmen and Eraña García López shows that more than a third of exports of multinational corporations (MNCs) are of very high complexity in three main groups of countries. They believe that the higher the complexity of the product, the greater the volume of trade associated with GVCs and the impact on EU countries that have a wider set of opportunities for coordinating their activities (Díaz-Mora, & López, 2019).

Another example of this is the econometric evidence presented by Hermida et al (2018) that confirms the hypothesis that fragmentation and participation in GVCs provide higher growth rates for countries and also means that the country's position in these chains is important for the creation of a supportive business environment: growth in countries, which specialize in upstream activities in high technology and services sectors, tends to be faster than in countries located in primary sectors.

The formation and functioning of GVCs occurs through the agreement of various interests of actors within and outside of the corresponding organizational forms and economic connections, with the help of selected methods and incentives. So in the conditions of transformational changes in the global space in the 21st century, the formation of conditions for the development of GVCs at the state level deserves the most attention. This can be explained from two points: firstly, in modern economic literature, there is a considerable amount of research in this field, beginning with the eclectic paradigm of Dunning, which first developed the basic theoretical positions of the theory of international production and the causes of transnationalization, as well as attempted to determine the role of the state in this process (Dunning, 1990). Also, scientists Buckley and Hashai (2004) identified the theoretical aspects of the corporate strategy of controlling the production chain and the choice of localization (within a particular national economy) of individual segments of a GVC by identifying flows of information and production resources within the framework of global value chains. It should be noted that the theory of GVCs is based on a concept crucial for the fields of strategic management and international business, the value creation chain - or simply value chain - that also describes the creation of value in a chain of interrelated product or service operations.

The most important approach to identifying the value chain is the theory of competitiveness of Porter (1985, p. 33) and the concepts developed by Ghereffi (1996), which emphasize the magnitude of the term "value chain" and suggest its use for analyzing the activities of leading international companies on a global scale. The conducted preliminary analysis of the methodological basis of the formation of global value chains allows to propose an own, author's understanding of their content: a global value chain is the economic relationship between the parties to a single production process that concentrates certain elements of its production, promotion and distribution of newly created products and services in the global space, while taking into account its inhomogeneity in terms of available factors of production and the level of integration into network systems. So, in the context of this analysis, the definition of a GVC is reflected in the distribution across national borders of production processes that combine complete or taken partially elements of value chains located in different national territories.

Identifying the peculiarities of the development of GVCs based on MNCs also deserves particular attention. Since companies of this type are forced to look for new ways and strategies for developing and improving their positions at different levels of global value chains in the conditions of the transformation of the world production system taking place in the XXI century (Fleury, et al 2013; Pananond, 2015) it is of interest for the further development of the theoretical foundations of international business and strategic management in relation to the economic development of countries that are catching up, like Ukraine, because the earlier studies were based on analyzing companies from developed countries, thus not taking into account the peculiarities of companies from countries with developing markets (Narula, Dunning, 2010; Ramamurti, 2012).

The second standpoint, which focuses attention on the state level of coordinating the operations of GVCs, is based on the fact that, in determining the direction of fragmentation of MNCs' production processes, comparative advantages of countries (such as the relative cost of labor, level of infrastructure development, market capacities), that influence their competitiveness and the price of production factors, play a special role. This provides an implicit explanation of the processes where certain parts of MNCs' production chains relocate between countries in accordance with changes in the relevant comparative advantages. Rapid innovation against the background of technological changes prompts the constant reconfiguration of GVCs, including the reconsolidation and repatriation of their segments into developed countries. Thus, constant study of the global market becomes relevant from the perspective of MNCs' and MNCs', aimed at identifying the most effective locations for GVCs' production units.

Meanwhile, the growing importance of the state as a subject of specification and protection of property rights at the macroscopic level and the main bearer of national interests in the functioning of GVCs warrants a more thorough study. The state acts as an arbitration party, which guarantees compliance with relevant agreements; its dominant objective, in this context, is to create a property ownership structure that would maximize the economic impact of placing GVCs in its territory.

### 3. Methods and information sources of research

The study uses a complex of complementary methods of scientific identification of economic processes and phenomena: the system-structural, comparative and statistical analysis - for studying the current state and main trends in the development of global production (on the example of the automotive industry), and the territorial, resource, informational, process and institutional approaches for analyzing the formation and functioning of GVCs. The information base of the research is formed by statistical and analytical materials and informational and analytical collections, bulletins and reviews, made public by such sources as the Organization for Economic Cooperation and Development, World Bank Group, European Bureau of Statistics, Ukrainian and foreign research centres, factual information provided by state authorities, a wide range of domestic and foreign literary sources, and results of own research.

### 4. Results and their discussion

In the framework of further identifying the features of GVCs' control at the macroeconomic level, the subject-object relations that arise in the process of formation and development of these chains have been investigated. The objective component combines the interaction and effect of the principles governing the process of fragmentation of international production. It is determined by: the geographical location of the participant in the chain (current or future); the type of economic growth in the country where the chain segment is localized; the degree of technological development; the objective component that forms the foundations and limits of the distribution of production processes; specific motives and interests in participating in the GVC, the choice of objectives and means of regulating this process, and the assessment of their costs and effects. The subjective component contains a set of conscious interactions in the chains, including their corresponding forms, methods and incentives. In our opinion, any economic agent that directly or indirectly participates in the management of the processes of formation and functioning of GVCs in the world economy (Table 1) should be considered an economic agent of GVCs.

**Table 1.** Subjects participating in the management of formation and operation processes of GVCs

Level	GVC Subject	
Supranational and national	MNCs, MNBs	Direct participants
	Governments, integration groups, intergovernmental institutions, central banks, public organizations and non-state institutions	Mediated participants
National and regional	Territorial administrations, governments of autonomous districts	
	Firms, enterprises, including small and medium enterprises	Direct participants



*Source: developed by the authors*

In this context, these entities primarily seek to meet their most pressing needs, on the basis of which arise the relevant motives for interaction within the GVC or in its formation. In the context of this study, relations of the main direct and indirect participants - MNCs and governments - are the most important in the process of managing production chains.

The monopolarity of the world economy, in fact, causes not only the optimization of the costs of the production process, but also the implementation of the so-called "cosmopolitan rationality" for national economies, which renders national investments into sectors that are already represented on the world market by competitive producers inefficient. In the phase of globalization of the international business environment, the interests of business entities, primarily MNCs, which coincide with the national interests of the states in which the companies are registered, play a dominant role over the national interests of the recipient countries of the activities of these actors. Transnationalization in modern conditions is a qualitatively new stage in the internationalization of economic life, which is a process of strengthening foreign economic activity as a result of global operations of MNCs (Dzhusov & Pavlovich, 2015). Today, of the top 100 MNCs, 35 are based in the United States, 42 in Europe, 21 in Japan, and only 2 in other regions of the world (UNCTAD, 2017). However, this does not mean that the real production belonging to those MNCs is localized in the countries where the parent companies are based. It is the investment decisions of MNCs, which are connected to the involvement of independent contractors and offshore operators, act as the main factors behind the creation of GVCs worldwide.

Let us note that the goal of supra-state interactions in this area is to encourage the innovation processes, further reduce trade costs and overcome differences without raising tariff and non-tariff barriers, strengthen the international taxation system and mitigate the effects of and overcome climate change. Relations within production chains are based on stimulation rather than containment of the processes of developing and introducing technological innovations. But, new technologies serve as an instrument for maintaining control over production within the economies of developed countries, provided by two main methods:

- Keeping the more technological stages of given production processes in the developed countries;
- Providing control over the transfer of information needed to organize the production process on a global scale (Cantwell, 1998).

Moreover, newer technologies remain by the owner, whereas older ones are distributed downwards on the links of the chain in order to "pull" the participants of the interactions up to the desired level of development. Such a system is characterized by the presence of new types of control, which in general can be defined as "new protectionism", which functions at the higher level of ideas, developments, patents and brands. The system of "new protectionism" aims to reduce the benefits of using cheap labor, which is reflected in lively discussions on "social dumping".

In the first quarter of the twenty-first century, new economic centres (poles) are being formed, based on the possibilities for developing and introducing new technologies, in conditions of active competition between leading countries. The key actors in the fragmentation of global production are identified, with the fragmentation manifesting in the classification of four fundamentally different groups of countries:

1. Countries that develop fundamentally new technologies (first-level technologies);
2. Countries with the scientific and technical potential and investment resources sufficient to implement first level technologies and to create further modifications (technologies of the second level);
3. Countries that are likely to be able to implement separate components of new second level technologies or base their production processes on the developments of previous generations of technology.
4. Remaining countries that are unable to use components of new technologies in production processes.

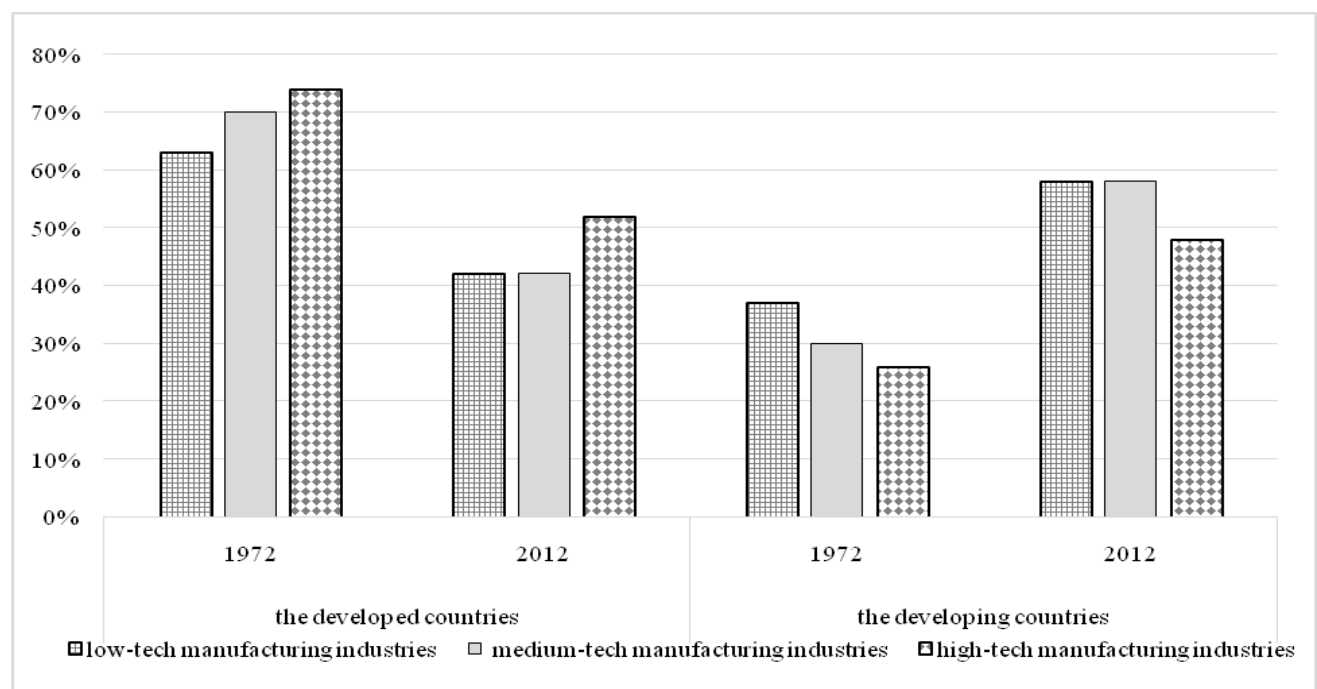
It should be noted that this distribution is subjective, since within groups, subgroups of countries may be identified with a sufficient level of scientific and technological development but very little participation in the functioning of GVCs, or of countries which act as global competitors in the development of fundamentally new technologies (first level technologies).



In turn, MNCs are linked to the core of the global economic system through GVCs and today control more than half of the world's trade and finance turnover, including the most profitable manufacturing industries from different countries (mining and high technology industries, telecommunications and industrial infrastructure), which at the same time form the foundation of 5th and 6th waves of innovation.

For example, in 2012, more than half of the world's value added in low- and medium-technology industries was created in developing countries, and even the high-tech industries of developing countries contributed almost half of the total value added (Figure 1).

Thus, the main instrument of superstate regulation is the protection of intellectual property rights in global production, with the main stakeholders being MNCs. This is due to the exhaustion of opportunities for the growth of the previous technological structure, when corporations, faced with the decline in the growth rate and profitability of their financed industries, begin to search for fundamentally new opportunities for investment including taking into account the life cycle of TNCs and MNCs (Koval et al., 2017). In this case, it is about the advantage that global financial agents possess in providing for both technological development and the functioning of GVCs within the modern business environment. This conclusion is supported by data on dozens of major FDI recipient countries in 2015, which include the United States (384 billion USD), Hong Kong (163 billion USD), China (136 billion USD), the Netherlands (90 billion USD), United Kingdom (68 billion USD), Singapore (65 billion USD), India (59 billion USD), Brazil (56 billion USD), Canada (45 billion USD), and France (44 billion USD) (UNCTAD, 2017).



**Fig. 1.** The share of developing and developed regions in the creation of global added value in low-, medium- and high-tech manufacturing industries, 1972 and 2012, %

*Source:* compiled by UNIDO according to (Lavopa and Szirmai, 2015)

The implications of future technologies are unknown, but some of the possible problems associated with current technologies can already be foreseen. For example, due to the introduction of latest technologies, production and services would be transformed in the coming years in such a way that the question will arise as to how quickly can new jobs be created. That is, a knowledge-based post-industrial economy forms an ever-increasing demand for workers with higher education and qualification (Meshko & Tarabara, 2012; Mura et al., 2017). Also, according to a group of scholars, technical advances already create greater value for consumers than is currently reflected in national statistics (Boskin, et al., 1998; Brynjolfsson, et al., 2019); these issues need to be addressed quickly, which

is why the Inclusive Development Index (IDI) was presented by the World Economic Forum in 2017 (details in Schwab & Sala-i-Martin, 2016). This index presents the comparative analysis of the socio-economic development of countries in a way that provides a more comprehensive vision of integrated economic progress in the international business environment. It includes indicators that reflect growth and economic development (employment, life expectancy, GDP per capita), (Pukala, et al., 2014), "inclusive parameters" (Poverty and inequality levels), and sustainability (net savings, CO2 emissions per unit of GDP, public debt, the ratio of working-age population to incapacitated). So, in order to achieve successful inclusive growth, structural reforms and investment in human capital (including access to education and labor market flexibility) should be accelerated.

To achieve this, the state needs to take into account the existing and create the additionally necessary legal, regulatory, informational, financial, technical, personnel-related and other provisions for the functioning of GVCs, to apply appropriate methods, to form and employ appropriate incentives. The functions of such coordination should include:

- the legislative-normative function (formation of a single "legal field", the support and development of which ensures the economy of resources in the interaction of economic agents with each other, and since the rules of operating on the "economic field" are clearly defined, that is, the rights and responsibilities of each agent are understandable to all parties, the problems of cooperation in the GVCs would be most often resolved without intermediaries such as courts, arbitration, and state bodies);
- the informative function (timely provision of necessary information to economic entities);
- the social function (qualified and responsible economic subjects distantiate from the ideology of opportunistic behaviour, which inevitably contributes to the reduction of transaction costs associated with the GVCs' functioning).

The role of the state in coordinating the functioning of GVCs is to create institutions of communication between the economy and society, between economic and social development at the macro- and mega-levels of the economic system. Modern state institutions should provide manageability, which is a dynamic state, which implies the openness of public administration to reforms that are the implementation of the state's dynamic capacities in complex and uncertain conditions.

The trend of searching for a new model of management at the macro level began to emerge after the financial crisis of 2008-2009, as well as in the context of increasing complexity of the transformations taking place in the world economy. Scientific and technological advances transform the combination of factors of the production process in the world economy due to the spread of global value chains, which leads to an increase in interdependence of countries. Formation of GVCs occurs under the influence of a system of formal and informal requirements, rules, and norms that affect changes in the socio-economic environment. In the manifestation of this process, the role of the state is very important, which is to create an institutional environment for the promotion of the activity of GVCs in order to reconcile the various interests of network interactions' subjects.

The following characteristics of the state are important in its interaction with TNCs in the process of creating the conditions for the formation of GVCs:

- the ability of a state to use its strategic resources to improve its competitiveness in the world;
- the permanent coordination of the state's corresponding interests in the world;
- the ability of public authorities to cope with the challenges of the external and internal environments;
- the sustainability of coalitions for supporting the policies in various spheres of societal development, based on a high degree of social cohesion and the ability to politically compromise;
- the formation of cooperation in the relationship between the state, business and society, as well as the stimulation of these relationships through involvement in publicity.

In the context of this problem, it should be noted that, in the formation and functioning of these chains, there may be a conflict of interests between the participating state and MNCs. This is explained by the fact that foreign business entities and local authorities have different goals and count on different parameters of the partnership at the moment of laying the foundation for their interaction. The state, acting as the guarantor of the welfare of the nation, in cooperation with the MNCs seeks to stabilize macroeconomic indicators, modernize the basic infrastructure,

improve the living conditions and standards of life of the population, provide environmental safety etc. (Koval et al., 2019); MNCs, in turn, put in the first place the optimization of their own economic activity.

In the interaction of international business and the state, depending on the level of socio-economic development of the latter, as well as its priority directions of development, the state as the subject creating the conditions necessary for the functioning of GVCs has the right to take into account a number of elements that directly or indirectly affect the management of these interactions. Moreover, the state has the authority to use these strategic parameters, on the one hand, to stimulate the presence of foreign business, and on the other hand, as tools for regulating the presence of certain stages of the production process in its territory as a condition for the admission of MNCs to its market.

Table 2 shows the parameters that, in the authors' opinion, should be taken into account by the state in the interaction of the government and international business in managing the processes of GVCs' functioning. Moreover, the contribution of the listed parameters may be different depending on the country and in accordance with the peculiarities of the formation and development of GVCs.

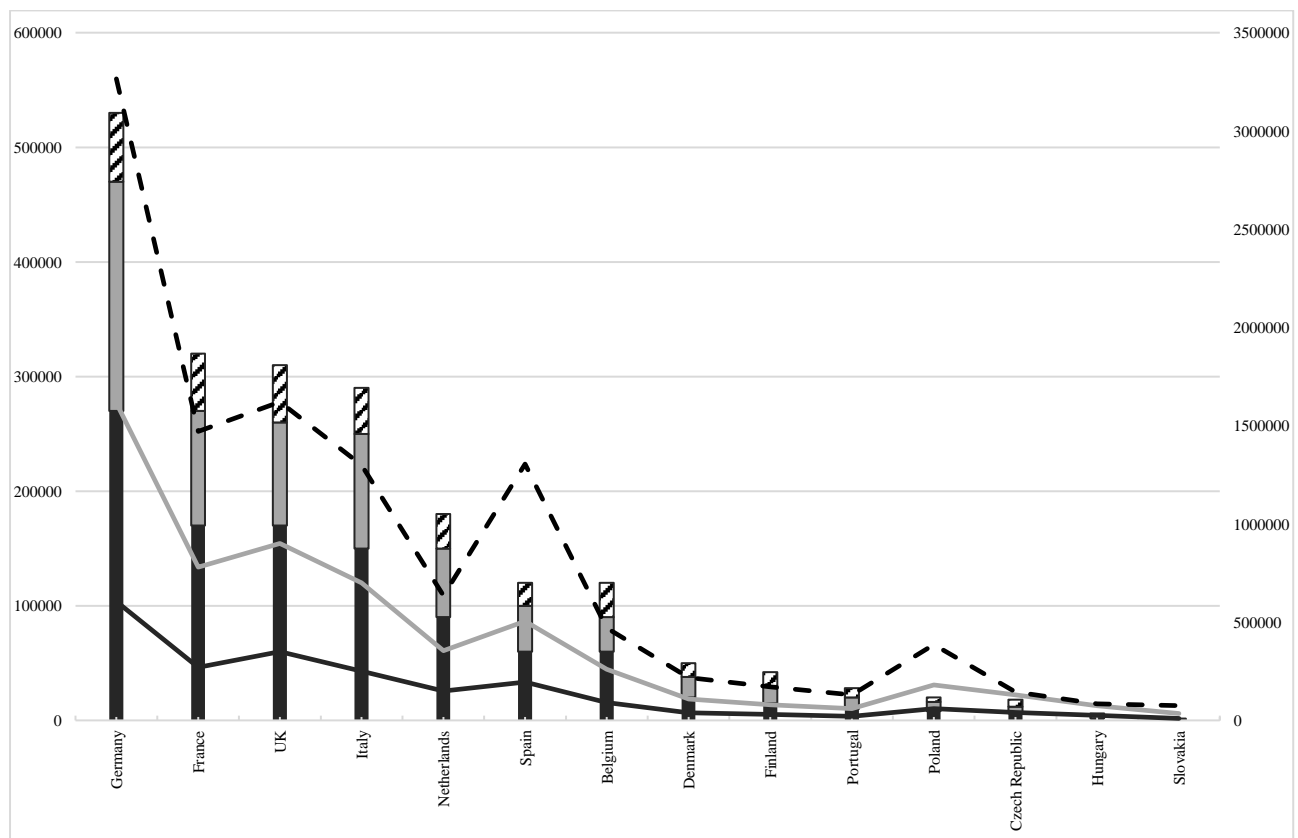
**Table 2.** Parameters that are taken into account by the state when managing the operations of GVCs

No	Parameter	Main content and management indicators	Basic tools (regulators)	Management results
1	2	3	4	5
1	Ensuring employment	- the level and reason of unemployment in the country; - unemployment structure; - quantity and quality of created jobs;	- state support of both local and foreign investors (construction of new enterprises and / or establishment of joint ventures on the basis of existing ones)	reconfiguration of international production segments by means of achieving optimal inter-industry proportions of production between sectors of the economy
2	Security of local investors	- existing conditions in the country (infrastructure), stimulating national business; - fair competition; - effectiveness of anti-dumping measures active economy	- targeted support of industries that have lost their competitive position as a result of deindustrialization processes or pro-viding new goals for economic growth (ecology, stability, inclusiveness); - development of complex national legislation that deter-mine the optimal performance of international production networks in the country;	- strengthening the regional component, creation of innovative clusters on the basis of the principles of "reasonable specialization" and support of SMEs; - availability of innovative technologies for domestic producers; - development of domestic suppliers of 1st, 2nd and 3rd levels, of technological and service centres
3	National security	- branches into which foreign investments are directed; - strategic industries in the national economy		
4	Foreign trade	- geography and structure of the country's foreign trade; - availability of preferential agreements; - the state of trade and economic relations with the investor countries	- ensuring the harmony, sustainability and efficiency of international production and trade cooperation; - support of enterprises that create goods and services with high added value	the compatibility of implemented economic policies with those of the countries from which the investments flowing into the national economy originate
5	Fiscal policy	-taxes collected in the country; -main sources of budget replenishment; -customs regulation in the country	tax holidays and incentives for innovative enterprises and private investors	accumulating capacity for the development of new functions aimed at transitioning into more profitable segments of GVCs
6	Priority directions of development	- industries that require investment; - support of the national innovation system; - deficit branches of the national economy; - a list of intermediate goods for which there is demand from local producers	- creation of technology centres and business support centres; - programs of structural funds; - state support of innovations in science-intensive industries; - reforming the sphere of education (duality, inclusiveness, "education throughout life")	- development of the types of national economy's activity that are most promising in terms of effective participation in the GVCs; - technological development of all spheres of societal activity; - acceleration of the movement of foreign investment, which is catalysed by technological development.

7	Political stability	<ul style="list-style-type: none"> <li>- existing conflicting (threatening) situations in the country</li> <li>- the attitude of the society to local authorities;</li> <li>- political situation in neighboring states</li> </ul>	<ul style="list-style-type: none"> <li>- information support of national development programs;</li> <li>- promoting public-private partnership in various spheres of public life;</li> <li>- implementing the principles of a democratic society</li> </ul>	<ul style="list-style-type: none"> <li>- levelling social tensions in the process of transforming the production structure of the national economy</li> <li>- taking into account the fact that the entry competition in the most profitable GVC segments is constantly increasing, whereas the incomes of their participants are decreasing, in developing national development strategies</li> </ul>
8	Other benefits	<ul style="list-style-type: none"> <li>- the comparative advantages present in the country</li> </ul>		

Source: developed by the authors

In confirmation of the above, let us consider the experience of combining the national and supranational levels of the development of GVCs in the automotive industry of the countries of Central and Eastern Europe. European countries were chosen for analysis because the European practice of managing GVCs at the macro level employs a structured approach to implement on the opportunities provided, which, along with other measures, involves increasing the production potential of national producers. A good example is the significant increase in gross exports in absolute terms in recent years from France and Poland, as well as Hungary, Slovakia and the Czech Republic (Figure 2). In the construction of Figure 2, the data of the “Trade in Value Added (TiVA)” database (OECD, 2016) were used, which was created by the joint efforts of OECD and WTO. The database is open for general access since 2013, with the latest statistical observations dating back to 2011. Such a significant delay in the provision of information is associated with the high laboriousness of its processing, as well as the frequency with which individual countries calculate their “Input-Output” tables, since not all countries do it annually.



**Fig. 2.** Components of gross exports of some EU countries, 1995 and 2011, million USD

Legend: columns (accumulated total) – in 1995, lines (accumulated total) – in 2011; black dashed line – direct (that is, created directly by exporting industries) value added, created in the economy and exported abroad; gray – mediated (that is, created in industries, products or services of which were used in the production process as intermediate) added value created in the economy and exported abroad (Indirect domestic value added content of gross exports); black – foreign value added, created in the economy and exported abroad (gross exports); Also reimported value added created in the economy and exported abroad, and then returned to the economy (and again used for the production of export goods) is also taken into account (Re-imported domestic value added content of gross exports). Source: compiled by the authors on the basis of TiVA Database, OECD-WTO, October, 2015 (OECD, 2016)

In line with these transformation processes in the CEE region, the automotive industry began to develop rapidly. It should be noted that the automotive industry is of great importance for the economy, because it combines many of its sectors — from the metallurgical production to the latest technology development in the field of electronics. It is because of the fact that many industries are involved in the automotive industry - for example, the production of glass, rubber, plastics, metalworks, electronics, as well as technical and consumer services, finance and many others - that the creation of one job in the automotive industry provides for additional jobs in other industries.

The geographic location of these countries has played a strategic role for the growth of direct foreign investment flows (FDIs) of the world's largest automakers, since the factories located there can supply products to both the West and the East: the volume of accumulated FDI in the production of electrical equipment, automotive, electronic and optical equipment in Hungary amounted to 3.7 billion USD, in the Czech Republic – 1.5 billion USD; In the production of vehicles and accompanying equipment – 4.1 and 14.8 billion USD, respectively; In the production of machinery and other equipment – 1.7 billion USD in Hungary (OECD, 2016). The share of FDI in the region's automobile industry constituted 10–15% of the total volume of foreign investment in the CEE industry in 2000 (Radosevic, Rozeik, 2005, p. 25).

In general, the significant growth of the automotive market in CEE began in the 2000s. At that time, the share of Central and Eastern European countries in the world production of cars was only 2.5%, and 7.1% in the Europe-wide production. By 2014, the situation has changed: the share in world and European production has increased to 4.1% and 17.8%, respectively (OICA, 2016). The result of the rapid restoration of most of the CEE countries is the continuing operation of factories, which took an as flexible as possible approach to the production process in that period. CEE governments, in turn, provided certain benefits to producers during the crisis and supported them through various investment incentives. In particular, in Slovenia, value added tax was reduced from 20% to 8.5%, and special support was given to companies with high added value (Pavlinek, Zenka, 2010, p. 349–350).

Foreign economic activity data account for 56.1% of the total value of exports of Czech goods calculated on the principle of value added, 54.0% of Hungary's exports and 52.5% of Slovakia's exports. At the same time, foreign economic activity data accounts for 64.3% of all foreign value added in Czech exports, 67.6% in Hungary, and 57.9% in Slovakia (OECD, 2016).

In our opinion, such a large-scale inflow of foreign investments is explained not only by favorable economic factors prevailing in the region, but also by the active participation of the governments of the CEE countries in the development of the automotive industry. Some of them developed an effective industrial policy to support the industry, including domestic and foreign investors. Ways to stimulate investment include various measures, from "tax holidays" to financial rewards for the creation of new jobs. For example, in the Czech Republic, investor companies can have up to 25% of their costs reimbursed (CzechInvest, 2015, 16 p.).

In addition, the European Union provides the possibility of using the EU Structural Funds program, which stimulates the establishment of R&D centers, training centers, the implementation of energy conservation projects, the reconstruction of buildings, etc. For example, from 1998 to 2014, the volume of investment in the automotive industry that passed Through CzechInvest amounted to over 10 billion EUR; more than 300 projects had been implemented, in 62 of which state support bore more than 50% of the cost (CzechInvest, 2015). The largest project implemented through the investment incentive program was the construction of a Hyundai Motor plant in the Moravian-Silesian region, in which Korea invested about 1.2 billion EUR from 2006 to 2008, and the assistance of the Czech government amounted to 15%. The Hyundai production involves about 3,300 workers, and about 7 thousand jobs have been created by supplier companies of all levels that followed Hyundai to the Czech Republic (CzechInvest, 2015, p.10). Before that, in 2002–2004, Japan had invested approximately 740 million EUR in a joint venture Toyota Peugeot Citroen Automobile, and Germany invested about 500 million euros in Skoda Auto in 1998. Since then, Skoda has continued to invest in the development and expansion of its production, reaching a value of more than 830 million EUR, 30 of which were used in the construction of a technology center in 2006; the state's assistance in this case was 40% (CzechInvest, 2015).



In Slovakia, there is also an agency for investment and trade development, SARIO (Slovak Investment and Trade Development Agency), financed by the state and operating under the supervision of the Ministry of Economy. The goal of the agency is to improve the living standards of citizens by increasing employment and reducing disparities among regions. To do this, it promotes national and foreign investment projects, facilitates the provision of state support, creates databases on existing real estate and industrial parks, and contributes to the creation of Slovak and foreign joint ventures.

An important aspect of the CEE countries' ascension into global value chains is the government support not only for producers, but also for the development of domestic suppliers of the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> levels, of technological and service centers. For example, 56 of the top 100 global suppliers in the automotive industry are based in the Czech Republic (CzechInvest, 2015, p. 8). Certain forms of support for high-quality industrial projects are also used. One option is maximizing the profit from using investment incentive schemes provided directly by the government that can be used by both new companies and those already operating in the field of car manufacturing, technology centers and business support centers (software development, information, service centers, call centers, etc.).

Another important factor is the state support for innovations in high-tech industries. For example, the assembly production of leading automobile manufacturers in CEE countries are concentrated on a relatively small area covering Western Slovakia, the Eastern and Central Bohemia, Southern Poland and Northern Hungary (Table 3).

**Table 3.** Key automobile manufacturers in CEE countries, 2016

Automobile manufacturer	Brand	Country of production
1	2	3
VOLKSWAGEN GROUP	SKODA	Czech Republic, Slovakia
	VOLKSWAGEN	Poland, Slovakia
	AUDI	Slovakia, Hungary
HYUNDAI	HYUNDAI	Czech Republic
	KIA	Slovakia
RENAULT	RENAULT	Slovenia
	DACIA	Romania
TPCA	TOYOTA CITROEN PEUGEOT	Czech Republic
FIAT	FIAT	Hungary, Poland
PSA	CITROEN PEUGEOT	Slovakia
SUZUKI	SUZUKI	Hungary
Daimler AG	MERCEDES	Hungary, Slovenia
GM	OPEL CHEVROLET	Poland
Ford	Ford	Romania

*Source:* compiled by the author according to the data from (OICA, 2016)

In Slovakia, the number of those employed in the R&D has increased by 60% (to 14.7 thousand people) since 2002, although this amounts to only 0.7% in the employment structure of the population. Since the beginning of 2000, research and development spending has increased almost fivefold (to 670 million EUR), while continuing to remain less than 1% of the country's GDP (Eurostat, 2016). In the Czech Republic, between 2002 and 2014, the number of employed in the field of R&D increased by 2.3 times (from 15 thousand to 34.2 thousand), increasing the share in the total employed population from 0.3% to 0.7% (Eurostat, 2016). At the same time, the cost of research and development from 2000 to 2014 has increased more than fourfold. Another example is the number of large innovative firms that have emerged over the past decade in China, India, Brazil, and Israel; their share in the expenses of thousands of leading global innovation companies increased from 3% in 2005 to 14% in 2015. Ten years ago, 64 companies with corporate centers in China, India, Brazil, and Israel were represented in the Global Innovation rating; today, there are already 227 such companies (Jaruzelski, Schwartz & Volker, 2015).



Along with providing investment incentives, governments pay great attention to education and the labor market. In the Czech Republic, for example, technical universities are evenly distributed throughout the country. Since 2002, the number of students of technical fields has doubled and surpassed the mark of 94.5 thousand in the 2013/2014 academic year. The annual number of graduates in the last few years is at the level of 20 thousand, and the annual number of graduates of the graduate school has exceeded 8 thousand (CzechInvest, 2015, p. 12). In addition to universities, another source of skilled labor are the professional technical schools, where training lasts for 4 years and can be equated with a bachelor's degree. In Slovakia, in turn, there are 5 technical universities that train highly qualified specialists, including those in the field of R&D. In these universities, there are more than 43 thousand students of technical specialties enrolled and about 14 thousand graduates. More than 58 thousand students are enrolled in technical professional secondary schools. Since the beginning of 2000, a constant increase in the number of graduates of the faculties of mathematics and of technical specializations can be observed. In 2001, there were about 7 graduates per thousand population; by 2013, the indicator exceeded 18 graduates per thousand citizens (Eurostat, 2017). Slovakia is also reviving the tradition of double education: students receive theoretical education in schools and practical skills at enterprises; for implementing such a project, the Slovak government has been applying tax incentives since 2015 for companies implementing this model (SARIO, 2015, p. 12).

Thus, one can distinguish the following features of the formation of value chains in the industry, characteristic of most CEE countries:

- 1) a targeted government strategy for attracting foreign investment into the development of industries;
- 2) stimulation of national and foreign companies through cash grants and tax incentives;
- 3) step-by-step transition from a low-cost country (in terms of manufacturing) to a country specializing in technological and organizational innovations;
- 4) the generally positive effect on the economies of Slovakia and the Czech Republic that the development of high-tech industries has had.

Due to the development of the scientific basis and new technologies in the CEE countries, the growth of qualification of personnel and the increase in wages, the share of production of high value-added components will continue to increase, accompanied by the gradual relocation of activities with comparatively lower added value to other countries.

## **Conclusions**

As a result of the study of the specifics of GVC management at the macro level, it is determined that these processes occur primarily by the agreement of the various interests of the subjects of these interactions, primarily their direct (MNCs) and indirect (government governments) participants. In determining the direction of fragmentation of production processes of MNCs, comparative advantages of countries are of particular importance, which explains the constant reconfiguration of GVCs, including the tendency of consolidation and repatriation of their segments into developed countries becoming prominent in the last decade. From the point of view of host countries, there is an urgent need for substantiation and implementation of measures aimed at creating the conditions necessary for the improvement or preservation of the positions of national actors in GVCs (as well as the inclusion of new enterprises) in view of the diversity of the production cycle phases, structural constraints and the presence of opportunities for such policies. Thus, controlling GVCs at the macro level comes to the front in the conditions of the transforming global production in the XXI century, without diminishing the importance of corporate (or inter-corporative) management of production processes within GVCs.

States seeking to improve their position in the international business environment must introduce the institutional tools needed to improve the mechanism for reallocating income generated by exports of natural resources to the development of human capital, national innovation systems, institution and infrastructure creation, all necessary for attracting investments into production, with an emphasis on technological industrial business and the development of high-tech industries. The example of CEE countries proves that managing GVCs at the macro level through support for scientific and technological development, promoting FDI attraction and an appropriate human capital development strategy, which provides for the competitiveness of products and their distribution in foreign markets, is effective in the 21st century.

So, the institutional environment of the functioning of international production networks is formed by agreeing on the various interests of the subjects of network interactions. Public and state assistance to the activities of international production networks comes to the fore in identifying the main challenges of fragmentation: the growth of disproportionate distribution of income among the countries of the world economy, the depoliticisation of economic interaction through changes in the block thinking and the refusal of confrontation as a form of permanent state, the expansion of reconfiguration of international production networks, including the tendency of consolidation and repatriation of their links back to the developed countries. From the point of view of host countries, there is an urgent need to substantiate and implement measures to create conditions for the inclusion or preservation of the positions of national actors in international production networks in view of the diversity of phases of the cycle, structural constraints and the availability of opportunities for such policies. These topics will be investigated in the authors' further research.

## Reference:

- Arocena, R.; Sutz, J. 2000. Looking at national systems of innovation from the South. *Industry and Innovation*, 7(1): 55-75. <http://doi:10.1080/713670247>
- Arndt, S. W.; Kierzkowski, H. (Eds.). 2001. *Fragmentation: New production patterns in the world economy*. OUP Oxford.
- Brynjolfsson, E.; Collis, A.; Eggers, F. 2019. Using massive online choice experiments to measure changes in well-being. *Proceedings of the National Academy of Sciences*, 116.15: 7250-7255. <https://doi.org/10.1073/pnas.1815663116>
- Buckley, P. J.; Hashai, N. 2004. A global system view of firm boundaries. *Journal of International Business Studies*, 35(1): 33-45. <http://doi:10.1057/palgrave.jibs.8400059>
- Cantwell, J. A. 1998. The globalization of technology: what remains of the product cycle model? *Cambridge Journal of Economics*, 19(1): 155-155. <http://doi:10.1093/oxfordjournals.cje.a035301>
- CzechInvest. 2015 Automotive Industry in Czech Republic. *Investment and Business Agency* (accessed: December 2017). Retrieved from: [http://www.mzv.cz/file/672401/brochure\\_czech\\_automotive\\_industry.pdf](http://www.mzv.cz/file/672401/brochure_czech_automotive_industry.pdf)
- De Backer, K.; Miroudot, S. 2014. Mapping global value chains <http://doi:10.1787/5k3v1trgnbr4-en>
- Díaz-Mora, C.; López, G. E. 2018. Product Complexity in International Production Networks: Comparing EU Core and Old and New EU Periphery, *Emerging Markets Finance and Trade*, 55(4): 950-966 <https://doi.org/10.1080/1540496X.2018.1443073>
- Drăgulănescu, I.V.; Androniceanu, A. 2017. *Risk management in global sourcing*. 21st International Conference on Economic and Social Development, 18-19 May 2017, Belgrad, Serbia, Book Series: International Conference on Education and Social Development Economic and Social Development, pp. 695-702. Edited by: Jurcic, A., Oreski, D., Mikic, M. ISSN 1849-7535.
- Dzhusov, O.; Pavlovich, A. 2015. On the question of Ukraine's investment attractiveness for multinational corporation. *European Journal of Management Issues*, 23(5): 23-29. <http://doi:10.15421/191518> (in Ukrainian)
- Eurostat. 2016. Electronic resource. (accessed March 2018) Retrieved from: <http://ec.europa.eu/eurostat/web/education>
- Fleury, A.; Fleury, M. T. L.; Borini, F. M. 2013. The Brazilian multinationals' approaches to innovation. *Journal of International Management*, 19(3): 260-275. <http://doi.org/10.1016/j.intman.2013.03.003>
- Gereffi, G. 1996. Global commodity chains: new forms of coordination and control among nations and firms in international industries. *Competition & Change*, 1(4): 427-439. <http://doi.org/10.1177/102452949600100406>
- Gereffi, G.; Wyman, D. L. (Eds.). 2014. *Manufacturing miracles: paths of industrialization in Latin America and East Asia* Vol. 1189. Princeton University Press.
- Hermida, C. D. C.; Xavier, C. L.; Da Silva, G. J. C. 2018. Fragmentação Internacional Da Produção, Cadeias Globais De Valor E Crescimento Econômico: Uma Nova Abordagem Empírica, Anais do XLIV Encontro Nacional de Economia [Proceedings of the 44th Brazilian Economics Meeting] 105, ANPEC - Associação Nacional dos Centros de Pós-Graduação em Economia [Brazilian Association of Graduate Programs in Economics]. Retrieved from: <https://www.anpec.org.br/encontro/2016/submissao/files/I/i7-4f1ceab756e7ebc7f669b69fa3b5d752.pdf> (in Spanish)

- Jaruzelski, B.; Schwartz, K.; Volker, S. 2015. Innovation's New World Order. Strategy+Business. Retrieved from: <http://www.strategy-business.com/interactive/Where-Companies-Spend-Their-RD-Money>
- Johnson, R. C.; Noguera, G. 2012. Accounting for intermediates: Production sharing and trade in value added. *Journal of international Economics*, 86(2): 224-236. <http://doi:10.1016/j.jinteco.2011.10.003>
- Castells, M. 1996. *The Rise of the Network Society. The Information Age: Economy, Society and Culture*. Vol. I. Cambridge, MA; Oxford, UK: Blackwell.
- Kimura, F.; Ando, M. 2005. Two-dimensional fragmentation in East Asia: Conceptual framework and empirics. *International Review of Economics & Finance*, 14(3): 317-348. <http://doi:10.1016/j.iref.2004.12.005>
- Kimura, F.; Lee, H. 2006. The gravity equation in international trade in services. *Review of world economics*, 142(1): 92-121. <http://doi:10.1007/s10290-006-0058-8>
- Koval, V.; Prymush, Y.; Popova, V. 2017. The influence of the enterprise life cycle on the efficiency of investment. *Baltic Journal of Economic Studies*, 3(5): 183-187. <http://doi:10.30525/2256-0742/2017-3-5-183-187>
- Koval, V.; Petrashevskaya, A.; Popova, O.; Mikhno, I.; Gaska, K. 2019. Methodology of eco diagnostics on the example of rural areas. *Architecture Civil Engineering Environment*, 12(1): 139-144. <http://doi:10.21307/ACEE-2019-013>
- Labunska, Sv.; Petrova, M.; Prokopishyna, O. 2017. Asset and cost management for innovation activity. *Economic Annals—XXI*, 165 (5-6): 13-18. <https://doi.org/10.21003/ea.V165-03>
- Lavopa, A.; Szirmai A. 2015. *Industrialization in Time and Space*. Background paper prepared for the 2015 Industrial Development Report. Vienna
- Lösch, A. 1940. *Die räumliche Ordnung der Wirtschaft: Eine Untersuchung über Standort, Wirtschaftsgebiete und internationalen Handel*. G. Fischer.
- Lundvall, B. Å.; Joseph, K. J.; Chaminade, C.; Vang, J. (Eds.). 2011. *Handbook of innovation systems and developing countries: building domestic capabilities in a global setting*. Edward Elgar Publishing.
- Malerba, F.; Nelson, R. 2011. Learning and catching up in different sectoral systems: evidence from six industries. *Industrial and corporate change*, 20(6): 1645-1675. <http://doi:10.1093/icc/dtr062>
- Miles, E.R.; Snow, C.C. 1995. The new network firm: a spherical structure built on a human investment philosophy. *Organizational dynamics*, 23(4): 5-18. [https://doi.org/10.1016/0090-2616\(95\)90013-6](https://doi.org/10.1016/0090-2616(95)90013-6)
- Mazaraki, A.; Melnichenko, S.; Duginets, G. 2018. *Ukrainian economy growth imperatives*. Prague: Coretex CZ SE.
- Meshko, N. P.; Tarabara, O. V. 2012. Innovative dominant in modern educational paradigm. *European Journal of Management Issues*, 20(1): 19-26. <http://doi:10.15421/191203> (in Ukrainian)
- Narula, R.; Dunning, J. H. 2010. Multinational enterprises, development and globalization: Some clarifications and a research agenda. *Oxford Development Studies*, 38 (3): 263–287. <http://doi.org/10.1080/13600818.2010.505684>
- Mura, L.; Ključnikov, A.; Tvaronavičienė, M.; Androniceanu, A. 2017. Development Trends in Human Resource Management in Small and Medium Enterprises in the Visegrad Group. *Acta Polytechnica Hungarica*, 14(7): 105-122.
- OECD. 2016. Trade in Value Added (TiVA). OECD-WTO Initiative. 2016. Retrieved from: [http://stats.oecd.org/Index.aspx?DataSetCode=TIVA2015\\_C2](http://stats.oecd.org/Index.aspx?DataSetCode=TIVA2015_C2)
- OICA. 2016. International Organization of Motor Vehicle Manufacturers. Production Statistics. Electronic resource (accessed: March 2018) Retrieved from: <http://www.oica.net/category/production-statistics/>
- Pananond, P. 2015. Motives for foreign direct investment: A view from emerging market multinationals. *Multinational Business Review*, 23(1): 77–86. <http://doi.org/10.1108/MBR-02-2015-0008>
- Pavlinek P.; Zenka J. 2010. The 2008-2009 automotive industry crisis and regional unemployment in Central Europe. *Cambridge Journal of Regions, Economy and Society*, 3(3): 349-365. <https://doi.org/10.1093/cjres/rsq026>
- Porter, M. 1980. *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.

Porter, M. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.

Pukala, R.; Kafkova E. 2014, Development of commercial insurance in the Slovak Republic, Poland and Ukraine in the period 2004 - 2012, *Ekonomicky casopis*, 62(3): 285-306.

Pukala, R. 2016. Use of neural networks in risk assessment and optimization of insurance cover in innovative enterprises. *Engineering Management in Production and Services*, 8(3): 43-56.

Radosevic, S.; Rozeik, A. 2005. Foreign Direct Investment and Restructuring in the Automotive Industry in Central and Eastern Europe. *Economics Working Papers* 53. Centre for the Study of Social and Economic Change in Europe, SSEES, UCL: London, UK. Retrieved from: <http://discovery.ucl.ac.uk/id/eprint/17517>

Ramamurti, R. 2012. What is really different about emerging market multinationals? *Global Strategy Journal*, 2(1): 41-47. <http://doi.org/10.1002/gsj.1025>

SARIO. 2015. Automotive Industry in Slovakia. 12 p. (accessed: March 2018). Retrieved from: <http://www.sario.sk/sites/default/files/data/sario-automotive-sector-in-slovakia-09-2015.pdf>

Schwab, K.; Sala-i-Martin, X. 2016. The global competitiveness report 2015-2016. Geneva. In *The World Economic Forum*, 403: 1-92.

Stöllinger, R.; Hanzl-Weiss, D.; Leitner, S. M.; Stehrer, R. 2018. *Global and Regional Value Chains: How Important, how Different?* Vienna Institute for International Economic Studies.

Smith-Doerr, L.; Powell, W. 2010. Networks and Economic Life. *The handbook of economic sociology*, 2(3): 379-402.

Williamson, O. E. 1981. The economics of organization: The transaction cost approach. *American Journal of Sociology*, 87(3), 548-577. <https://doi.org/10.1086/227496>

World Bank. 2016. *World development indicators 2016*. World Bank Publications. (accessed March 2018). Retrieved from: <https://data.worldbank.org/indicator/NE.EXP.GNFS.CD?end=2016&start=2005>

Zeibote, Z.; Volkova, T.; Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development*, 1(1): 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))

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## WORKFORCE SEGMENTATION MODEL: BANKS' EXAMPLE

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**Abstract.** This article aims at a presentation of a workforce segmentation model deriving from M.J. Piore and P.B. Doeringer's concept of the dual labour market, as well as taking account of personnel policy instruments and perception of employment relationships. The results of theoretical analyses of workforce, enabled to build a new theoretical model of workforce segmentation. Such an approach has not been attempted at so far. In this model, the dimensions include the personnel policy instruments and perception of employment relationships, demographic, social and economic variables and analysis levels. This approach is a novelty, because the subject matter of research has usually comprised either quite narrow, selected aspects of employment, without reference to workforce segmentation, or wide, general considerations on workforce segmentation, without taking into account the specificity of its respective areas, let alone the micro-, mezzo- and international comparison perspective. Thus, developed model combines a typical business approach (taking into consideration various areas of employment) with an economic one, based on the notion of workforce and its segmentation.

**Keywords:** workforce segmentation; workforce segmentation model; personnel policy instruments; perception of employment relationships; banks; Poland; Russia

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**JEL Classifications:** J00, J4, A1, D00, C91, C92, E2

### 1. Introduction

Flexible forms of employment, discrimination, polarization, pauperization, the precariat – these terms are characteristic of the modern labour market. On the one hand, the economic growth that we can see in a majority of countries in Europe and the world, results in a rise in wages, an increase in the demand for labour and a fall of the unemployment rate, on the other, however, the change is unbalanced in various workforce segments. The situation in the labour market is specific for the following: young employees, people with disabilities, people over 50, women (relative to men), inhabitants of rural areas (in particular ones situated far from larger urban centres) and immigrants (Garbat, Paszkowicz 2016; Jarmołowicz, Kalinowska-Sufinowicz 2012; Mączyńska 2011;



Paszkowicz 2018). Labour market segmentation and workforce segmentation have their consequences in the area of education, training, poverty, social disparities, social security, etc. (Cain 1976). At the macroeconomic level, actions are taken so that the state should intervene in the market mechanism and level occupational inequality, an example of which was the introduction in Poland in 2017 of the minimum wage hourly rate.

Own observations, conversations with bank employees, discussions among experts dealing with the issue of employment, banking and Russian economy, as well as a review of domestic and foreign literature, allowed to identify an existing research gap with respect to workforce segmentation having regard to respective personnel policy instruments, perception of employment relationships and assessment levels (micro-, mezzo- and international comparisons). Authors, in their studies, usually focus either on an analysis of one employment area (Akhtar, Nadir, Nadir 2016; Bhati, De Zoysa 2013; Bąk-Grabowska, Jagoda 2015; Čiutienė, Petrauskas 2012; Elegido 2013; Fukuyama 1996; Fulk, Bell, Bodie 2011; Gębska 2018; Hajdin 2005; Heyes 2011; Jaźwiński 2017; Kotliński 2018; Kramer 2010; Lurie, Frenkel 2002; Seligman 1997; Soniewicki 2015; Wyrwa, Piątyśzek-Pych 2012) or on general considerations regarding workforce segmentation from the perspective of the entire economy or sector (Barron, Norris 1976; Battisti 2008; Berger, Piore 1980; Cain 1976; Garz 2013; Jarmołowicz, Knapieńska 2011; Musiał-Paczkowska 2003; Osberg, Apostle, Clairmont 1987; Wieczorek-Szymańska 2015); whereas in-depth analyses are missing. A deeper analytical and methodological approach is not there, either, in order to study and optimize workforce segmentation statistical research tools. There is no transition from the micro- level, via the mezzo- one up to the international comparison level. Thus, developed model combines a typical business approach (taking into consideration various areas of employment) with an economic one, based on the notion of workforce and its segmentation.

In this research, the main question is: how workforce segments are created in banks and what determines these? It was assumed that workforce segmentation may be analyzed at the level of detailed analyses of personnel policy instruments and perception of employment relationships which remain under the influence of factors related to the employee him/herself or the bank that employs him/her.

This article aims at a presentation of a workforce segmentation model deriving from M.J. Piore and P.B. Doeringer's concept of the dual labour market, as well as taking account of personnel policy instruments and perception of employment relationships. To accomplish the research aim the author used source literature in English and Polish on economics, human resource management, sociology and industrial and organizational psychology (EBSCO, The ACM Digital Library, BazEkon, Emerald, ProQuest).

The article presents the definition of workforce segmentation, being well-established in the theory of economics. Then, selected labour market segmentation theories are characterized. A workforce segmentation model in banks is depicted and a discussion of its results is held with regard to the labour market segmentation concept by M.J. Piore and P.B. Doeringer.

## 2. Literature review

It is assumed that a basis for intervention in the market mechanism should be a purposeful, coordinated diagnosis of segmentation. On the other hand, in respect of internal segmentation, taking place within an enterprise, familiarity with workforce diversity and awareness of disparities occurring between employees, not only allows one to defend oneself against allegations of discrimination, but also provides a foundation for implementation of a coherent recruitment, training, promotion, etc. policy. The segmentation itself, pertaining to the employment within an enterprise, may have both negative and positive outcomes. In macroeconomic terms, workforce segmentation is sometimes an intended means of the human resources policy. At the microeconomic level, one should be aware, for example, of price discrimination in the labour market. This means that, knowing the specific

character of his/her employees, the employer may diversify their wages, even if the work they perform is similar. This is favoured by pay secrecy, often popular in some sectors or industries (for instance, in the banking sector).

Labour market segmentation concepts separate segments of the entire labour market, whereas workforce segmentation often separates specific positions according to their characteristic features. Some authors think that the boundaries between segments separate various enterprises, some, on the other hand, that labour market segments are created inside enterprises and economic sectors as well (Zwiech 2013; Barron, Norris 1976). Nevertheless, relying on workstations in a number of enterprises, one may attempt to picture labour market segmentation. For instance, people motivated by employers by many incentives employed in a number of enterprises, may create a subsector of highly motivated persons. P. Piasecki is of a similar opinion: "in case of reproduction of similar activity patterns in a number of organizations in a given labour market (e.g. within the same industry), workforce segmentation may be transformed into labour market" (2018, pp. 9, 27). The author also adduces arguments for attribution of workforce segmentation to the discipline of economics (lack of specific outcomes of segmentation aiming to increase the organizational effectiveness, use economic theories, combine the micro- and macroeconomic perspectives). Workforce segmentation has not lived to see a clear and plain theory and researchers dealing with workforce segmentation most frequently rely on economic concepts of labour market segmentation.

It was assumed that workforce segmentation is a relatively constant state in which employees are divided into groups (segments) according to the use of personnel policy instruments, perception of employment relationships, wherein the essential criteria for the segmentation are employee-characteristic demographic and social variables and bank-characteristic economic variables. This approach is typical of economics which considers results of human resources management. On the other hand, it was assumed workforce segmentation, after L. Osberg, R. Apostle and D. Clairmont, as a set of employees and workstations (1987) that have undergone the process of segmentation. The Table 1 presents selected, most popular, concepts of labour market segmentation.

**Table 1.** Concepts of labour market segmentation

Researcher	Main assumptions
C. Kerr	<p>Segments</p> <ol style="list-style-type: none"> <li>1. Free (lack of mobility barriers, minor regulations)</li> <li>2. Institutionalized internal (various internal labour markets of different operating principles); it includes the following: <ul style="list-style-type: none"> <li>- market of specific professions</li> <li>- intra-corporate market</li> </ul> </li> </ol> <p>Reasons for segmentation:</p> <ul style="list-style-type: none"> <li>- limitations of mobility between respective groups in the labour market caused by various qualifications or restrictions regarding territorial mobility</li> <li>- lack of information</li> <li>- formal and informal rules</li> <li>- employers' associations and their informal agreements</li> <li>- trade unions</li> <li>- collective agreements</li> <li>- public administration activities</li> </ul> <p>Competition between segments is limited.</p>
B. Lutz, W. Sengenberger	<ol style="list-style-type: none"> <li>1. Unqualified workforce market (highly limited promotion opportunities, employees have common knowledge, positions do not require expertise, high employee mobility)</li> <li>2. Qualified workforce market (employees have universal qualifications, standardization and licensing/chartering of skills, the employer can be changed easily)</li> <li>3. Labour market for persons having qualifications adapted to the needs of individual workplaces (specific requirements for the employee, limited possibility to change the employer, long-term contracts of employment, great importance of professional experience)</li> </ol>

P.B. Doeringer, M.J. Piore: Dual labour market concept	1. "Primary" workplaces (original sector; usually large profitable enterprises, with trade unions available, legal protection, high job security, career development and promotion opportunity, career stability, high remuneration, strong identification with one's workplace, low personnel fluctuation, low unemployment rate within this segment); this segment is divided into the following: a) upper segment (independent; work implying initiative and creative activity) b) lower segment (subordinated; executive work implying high discipline in the workplace and reliability) 2. "Secondary" workplaces (secondary sector; opposite of the primary sector)
P.B. Doeringer, M.J. Piore, J.T. Dunlop: Theory of the internal and external labour market	1. Internal labour market (with limited access from outside, long-term employment relationships, career ladder, supplementation of price allocation with non-price allocation); it can be divided into the following: a) basic segment (key positions, opportunity for promotion, career stability) b) marginal segment (routine work, limited promotion opportunity, lack of stability) 2. External labour market (equilibrium created under the influence of pay variability) Competition takes place within a given area, whereas the factors triggering segmentation include, as follows: specific qualifications not applicable in other segments, training or on-the-job training, customs as to employees' wages and deployment
Segmentation theory, L. Thurow	1. Pay competition segment (employees compete with respect to wages) 2. Workplace competition segment (employees compete with respect to qualifications, level of education)
Concept of traditional – statistical division of the labour market	Segment operational principles (principles of allocation) may be the same. The labour market is divided due to various professional, demographic or spatial criteria. Markets are separated of individual professions, branches, lines of business and regions. There is no free movement of manpower between professions, regions and areas of the economy. There are labour markets for individual professions.
Conflict theory	Segments: 1. Insiders (employed at a given enterprise, having specific qualifications the cost of which has been borne partially by the enterprise) 2. Entrants (employed at a given enterprise, the enterprise has not borne significant costs in relations to employees' upgrading their qualifications) 3. Outsiders (people from the outside of the enterprise, the weakest of the three groups)

*Source:* Berger, Piore 1980; Cain 1976; Garz 2013; Golinowska 2001; Jarmołowicz, Knapieńska 2011; Kerr 1977; Kryńska 1996; Kryńska 2000; Kwiatkowski 2019; Leszczyński 2008; Loveridge, Mok 1980; Maniak 2003; Musiał-Paczkowska 2003; Osterman 1987; Pocztowski 1993; Polkowska 2016; Puzio-Waławik 2015; Reich, Gordon, Edwards 1973; Szambelańczyk 2001; Wachter 1974; Wąsowicz 2007; Zawada 2017; Zwiech 2013

Only selected segmentation theories are characterized in the article, particular attention is paid to M.J. Piore and P.B. Doeringer's concept of the dual labour market, which provides the basis for further analysis. The source literature describes amply other theories as well (Zwiech 2013; Piasecki 2018). Hence, repeating these would be redundant.

In the traditional segmentation approach, the primary labour market expands during high economic growths and gives way to the secondary market when the economy cools down. Simultaneously, any transition between the sectors is made difficult due to the fact that secondary segment employees have limited opportunities to acquire qualifications that are necessary in the primary segment (Kryńska 2000). In M. Battisti's opinion, segmentation is presently caused by work qualities, not the employee's traits (2008). On the other hand, research carried out by M.L. Wachter demonstrates that there are flows between the segments of the labour market and typical, bisegmental division into better and worse employees does not occur (1974, p. 678).

### 3. Theoretical model of workforce segmentation

The employment segmentation model based on research carried out in banks in Poland and Russia will be presented below (Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Aptacy,

Kaźmierczyk 2016). Several of the most important processes taking place in the last 30 years in banks in Poland and Russia have included, as follows:

- privatization of banks,
- opening of new banks (particularly in the first 2 decades of capitalism),
- taking over of a majority of the Polish banking sector by foreign capital,
- bank restructuring,
- bank mergers and acquisitions,
- revoking licences of a great number of banks in Russia,
- centralization of banking operations both in Poland and in Russia.

The above-mentioned main processes gave grounds for strategic changes at the level of individual banks. These, in turn, affected the organizational and personnel sphere (Pajak, Kamińska, Kvilinskyi 2016; Baszyński 2008). The developed employment segmentation model can be used for each sector, not just the banking sector (which was used as an example).

The theoretical framework of this research was the theory of workforce segmentation, wherein, contrary to the existing analyses presented in the source literature are not concentrated on general considerations relating to the entire market, but on selected personnel policy instruments (Chart 1):

- motivation,
- management by objectives,
- forms of employment;

and perception of employment relationships:

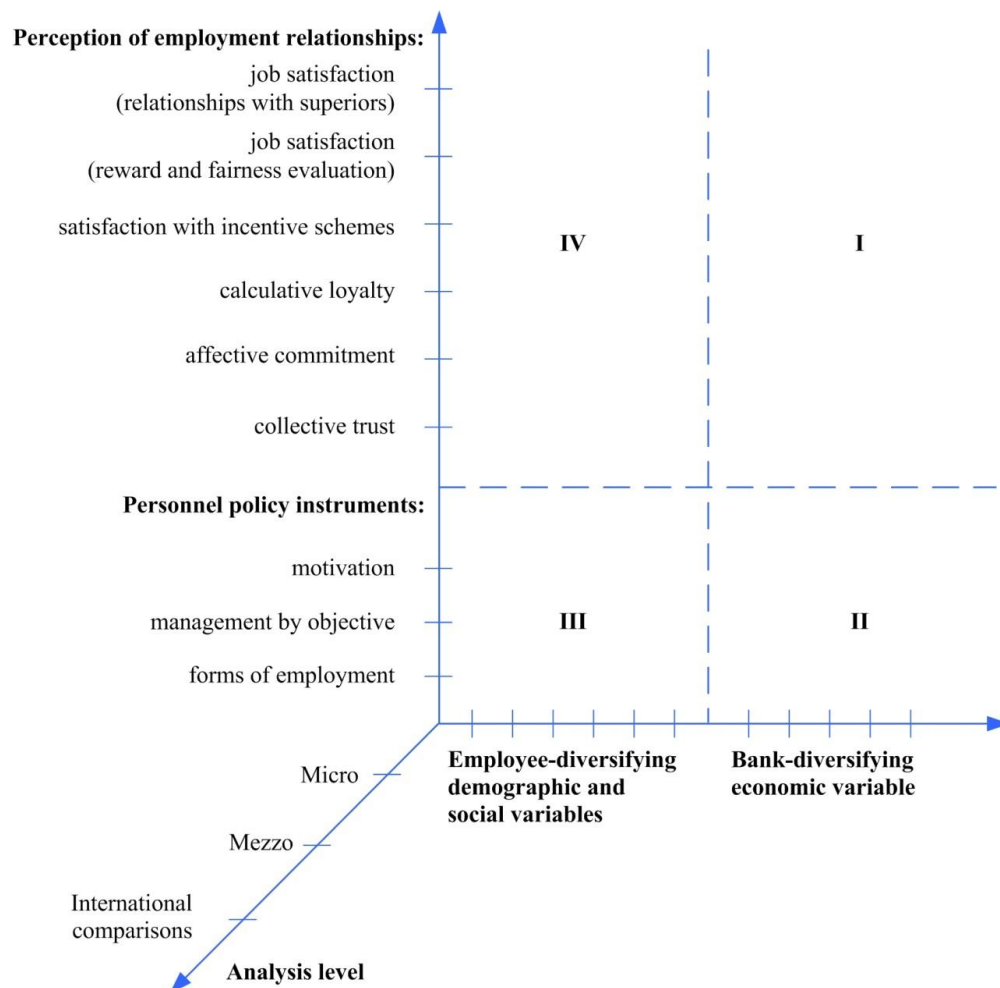
- job satisfaction – relationships with superiors,
- job satisfaction – reward and fairness evaluation,
- satisfaction with incentive schemes,
- loyalty – calculative loyalty,
- loyalty – affective commitment,
- collective trust.

The list of personnel policy instruments and perception of employment relationships can be extended and changed. In other words, any changes within the personnel policy instruments produce an eventual result in changes occurring in the perception of employment relationships. An analysis of personnel policy instruments and perception of employment relationships allows to create a more in-depth picture and draw regularities regarding banking labour market segments, particularly in the international and comparative contexts. In addition, the whole analysis is referred to the three levels, as mentioned above: micro-, mezzo- and international comparisons. In a majority of hitherto studies, a workforce economic analysis at the micro- level is not continued at the mezzo- and international comparison ones. Presented research goes further and focuses on analyzing micro- stimuli, which allows to grasp individual patterns of responding to stimuli coming from the economic environment, to generalize about tendencies at the mezzo- level and to compare the results at the international level – with regard to data from different countries (for example from Poland and Russia). Potentially there are many levels of mezzo- (in the context of constructivism there is practically an unlimited number of them).

Individual personnel policy instruments and perception of employment relationships are like building blocks, of which one may arrange various figures, able to show various relations. Within the framework of the project, only certain issues have been selected (the remaining personnel policy instruments and aspects of perception of employment relationships have already been, to a large extent, analyzed: Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Aptacy, Kaźmierczyk 2016).

Labour market segmentation or workforce segmentation has been dealt with by, to name a few (Table 1). They divided the market/workforce into submarkets, subsectors, subsegments, characterized by different parameters. There are "primary" and "secondary" segments, in many respects. Some authors think that the boundaries between segments separate various enterprises, some, on the other hand, that labour market segments are created inside enterprises and economic sectors as well (Zwiech 2013; Barron, Norris 1976).

One of the most popular and best developed concepts of labour market segmentation is M.J. Piore and P.B. Doeringer's concept of the dual labour market. They divided the labour market into two segments: "primary" and "secondary". Traditionally, the primary segment is characterized by higher wages, bigger career stability, better job security, better career development and promotion opportunities. On the other hand, employees situated in the secondary workforce segment receive lower wages, their work is characterized by smaller career stability, worse job security, worse career development and promotion opportunities. Such a division is interesting and frequently accurate, however, it does not take into account the industry's specificity, the influence of personnel policy instruments and perception of employment relationships. Considering a more analytical approach and expanding the theory to include personnel policy instruments and perception of employment relationships, demographic, social and economic variables and the micro-, mezzo- and international comparison perspectives, offers a more precise analysis and drawing more accurate conclusions.



**Chart 1.** The model of employment segmentation

*Source:* author's own elaboration.



The proposed model comprises three dimensions:

- personnel policy instruments and perception of employment relationships,
- employee-diversifying demographic and social variables and bank-diversifying economic variables,
- micro-, mezzo- and international comparison layers.

Personnel policy instruments (incentives, forms of employment, management by objectives) influence perception of employment relationships: relationships with superiors and reward and fairness evaluation, satisfaction with incentive schemes, calculative loyalty, affective commitment, collective trust; Chart 1, vertical axis). Analyzing empirical data, one needs to take account of any relationships between them. Presented analysis of personnel policy instruments and perception of employment relationships for employee-characteristic demographic and social variables and bank-characteristic economic variables (horizontal axis) provides a basis for drawing conclusions on segmentation, and in selected cases – also on employment discrimination. In the chart 1, developing workforce segments are easily noticeable (for instance, women employed in the same as men use a smaller number of incentive instruments). A "segmentation map" of a kind is created which shows, in graphic terms, where differences between employees are accumulated (the area between the vertical and horizontal axes). A workforce segmentation map can be analysed:

- vertically (then we answer the question what employees or what banks belong to the primary/secondary workforce segment, having defined previously what the primary and secondary mean),
- horizontally (then we answer the question how individual workforce policy instruments and perception of employment relationships are differentiated).

A supplementation of the picture is taking into account the micro-, mezzo- and international comparison approaches. In other words, the bidimensional model may be additionally superimposed by a more or less aggregated perspective (the third axis: "analysis level"), reaching as far as the level of international differences, for instance between Poland and Russia (Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017). Inasmuch as demographic, social and economic variables, depicted on the horizontal axis, and personnel policy instruments and perception of employment relationships, depicted on the vertical axis, as discreet data, the variables on the "analysis level" axis may be treated as continuous variables. The transition from the micro- approach, via the mezzo- one, up to the international comparison approach is smooth and consistent with the systemic and constructivist paradigm.

Presented research may be considered as comparative research. It is needed to identify employees' goals and adequately adjust and develop the personnel policy, as implemented. Furthermore, a comparative analysis offers an opportunity to derive knowledge from other people's experiences and internationalize one's research approach. Such an attempt was took with respect to Poland and Russia (Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Aptacy, Kaźmierczyk 2016).

A various demographic, social and economic variables which could potentially affect workforce, as well as the personnel policy instruments and perception of employment relationships under analysis were considered in empirical studies (Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Aptacy, Kaźmierczyk 2016). Among these the following were found:

- characteristics of bank units (country of origin; size of the locality; type of bank with respect to majority capital – domestic, foreign; type of bank with respect to organizational form – commercial, cooperative bank; bank unit – headquarters, regional branch, operating agency; type of work performed – front office, back office),



- as well as characteristics of employees (age; sex; education; experience in current employer; experience in banking; aggregate professional experience; position occupied – non-executive, lower, middle and senior management; disability; absence from work; declared sportive activity; hourly workload).

The abundant general instructions and personal information parts of the questionnaire used in the survey enabled a discerning, in-depth analysis of the issues in question, and separation of workforce structure and segments within given personnel policy instruments and perception of employment relationships. Each of these was analyzed in search of segments to be separated taking account of the above characteristics (Davydenko, Kaźmierczyk, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Aptacy, Kaźmierczyk 2016).

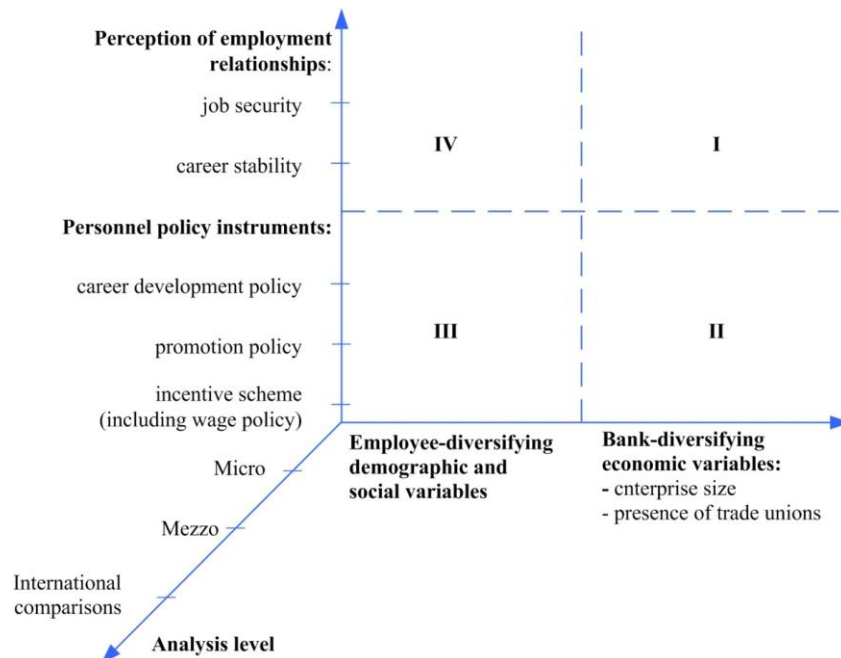
Within the proposed model, a "segmentation map" is developed taking account of any differences between workstations. The "primary" segment would be, for instance, one that is characterized by more stable forms of employment or a large number of incentives applied towards employees (within personnel policy instruments), as well as a higher level of loyalty, employee satisfaction and collective trust (within perception of employment relationships). Taking into account demographic, social and economic variables, on the other hand, makes it possible to check which employee or bank groups are characterized by a larger number of "primary" subsegments, and which ones – by a larger number of "secondary" subsegments. By means of an example, it may turn out that sex is decisive for being assigned to the "secondary" subsegment within the aspect of the number of incentives, but to the "primary" one within the aspect of collective trust. Thereby, one may check which demographic, social and economic variables cluster around themselves the "primary" subsegments, and which – the "secondary" ones. A repetition of such "primary" or "secondary" workforce subsegments within a number of personnel policy instruments and perception of employment relationships may confirm the hypothesis that a given demographic, social and economic variable does determine the assignment to either the "primary" or "secondary" workforce segments. For instance: if the female gender correlates with a smaller number of incentive instruments, more restrictive implementation of management by objectives, lower employee satisfaction, lower affective commitment and smaller collective trust, then one may pose a hypothesis that women belong to "secondary" employment areas. This will also confirm that women are discriminated against. By the same token, one may address discrimination based on disability or other personal characteristics.

Determination which segment is primary and which secondary, depends eventually on the researcher and conditions in which the study is done. He/she assumes, for example, that the primary segment includes such work that is characterized by a larger number of incentive instruments, higher collective trust and less frequent application of flexible forms of employment. One can also assume that the primary workforce segment is such segment in the case of which primary personnel policy instruments and perception of employment relationships outnumber secondary ones. In other words: where primary features aggregate more often secondary ones. Thus, the model is flexible and allows application in various conditions and different markets. Results may also be classified as primary/secondary according to employees or employers' opinions and expectations.

Presented research has been done under the influence of constructivism and systemic approach. It was assumed that everything that surrounds us is subjective, and pursuing any goals, as set (including profitability, efficiency, etc.) is often disturbed by extra-economic factors. This is particularly noticeable in the labour market which is very strongly connected with human emotions. In addition, every market participant, as well as a researcher, assumes his/her own definition of rationality, which arises out of his/her knowledge and experiences. Hence, every time an event, conduct or phenomenon is evaluated as rational or irrational, it is done subjectively. Both a researcher and market participants are not immune from a number of cognitive biases and influence of emotions. In addition, the assessor (researcher) often knows only selected aspects of the problem being analysed (Kaźmierczyk 2011).

#### 4. A critical analysis of M.J. Piore and P.B. Doeringer's segmentation model and the author's reflections

It is frequently thought that the concept of labour market segmentation by M.J. Piore and P.B. Doeringer is the best developed and popular among all labour market segmentation theories (Cain 1976, p. 1222). It has also become the basis for presented theoretical analyses. Economics, in its history, has repeatedly come into close relations with other sciences, including psychology. Already A. Smith referred to "The Theory of Moral Sentiments". The neoclassical mainstream separated economics a bit from the influence of other disciplines, which arose, among others, from the analytical approach, but also from the desire to argue for economics as an independent field. If until (approximately) the oil crises of the 1970s, successive economic schools quite clearly drew the boundaries of their operation and emphasized their autonomy, then later a return occurred in search of ties with other disciplines. The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel has been awarded many times to scientists combining economics with psychology, the behavioural approach or ethics and philosophy, the examples of which are D. Kahneman, R. Thaler and A. Sen. To sum up, modern economics (or its part, at least) is related quite closely to other sciences. One could even hypothesize that, as opposed to earlier periods, there is not a single economic mainstream. Eclecticism prevails, whereas other sciences serve as, so to say, a "drive" for economics. One can have the impression that behavioural economics is on the rise today. It is within this trend, taking account of the systemic approach and constructivism, that the model developed in present paper has been created. M.J. Piore and P.B. Doeringer characterize the workplace from the point of view of the employee. They treat such workplace as the primary one which offers more desirable (according to popular belief) qualities: starting with high remuneration, up to the nature of the employer's enterprise as a large. The model developed in the present paper, contrary to M.J. Piore and P.B. Doeringer, is not limited to the prescribed criteria of dividing the workplace into the "primary" and "secondary". In this sense, it is more flexible. Simultaneously, one may assign the characteristics of the primary and secondary segment of the labour market, as proposed by M.J. Piore and P.B. Doeringer, to personnel policy instruments, perception of employment relationships or economic variables, as characteristic of the employer, which are taken into account in developed model (Chart 2).



**Chart 2.** The bank workforce segmentation model vs. M.J. Piore and P.B. Doeringer's labour market segmentation model

Source: author's own elaboration.

Job security taken into account by M.J. Piore and P.B. Doeringer (in accordance with the systemic and constructivist approach) is a subjective characteristics and depends on assessment made by the employee. The situation is similar with career stability (or its lack – as in the case of job insecurity). The two classification criteria belong, therefore, to perception of employment relationships (the vertical axis). On the other hand, career development and promotion opportunities are a result of the personnel policy, as applied by enterprises, and, therefore, are classified among personnel instruments (the horizontal axis). The model proposed includes remuneration among incentive tools. Enterprise size and availability of trade unions are, on the other hand, economic characteristics of the employer (the horizontal axis). As one can see, therefore, the model proposed in the article seems to be a generalization of the model by M.J. Piore and P.B. Doeringer.

Additionally, a number of other criteria and factors may appear that determine segmentation, which have not been taken into account by M.J. Piore and P.B. Doeringer. Furthermore, in the context of dynamic changes of the modern labour market, doubts are raised as to the categorical adoption of what is "primary" and what is "secondary" for the employee. Perhaps working for big corporations (which do not allow for development and require one's activity within a rigid framework of rules and policies) is not something desirable by the employee, and thus cannot be classified as belonging to the primary workforce segment. A similar opinion is presented by M. Garz (2013), who considers that nowadays a number of temporary positions fall within the scope of the primary labour market, whereas full-time employees sometimes belong to the secondary workforce segment. It seems to be a much more pro-employee approach to enable the employee to express what he/she expects him/herself, and then to classify the workplace as a primary or secondary one according to the employee's indications. Similarly, one may have doubts as to the operation of trade unions (and their effectiveness, particularly in Central and Eastern European countries and post-Socialist states).

M.J. Piore and P.B. Doeringer acknowledged that one's transfer into the primary segment of the labour market is limited by a pre-assumed career ladder, employee evaluation modes and dismissals (Kryńska 2000). These factors may be taken into consideration in developed model as well, within employment policy tools. It seems that the remuneration aspect is the least controversial, in which case a vast majority of employees (if not all) would like to earn as much as possible.

The model by M.J. Piore and P.B. Doeringer met the needs of the 1960s. It was supposed to help fight poverty and marginalization of certain social groups. The segmentation model proposed in this paper is a response to modern problems of the labour market: the polarization of the labour force, the entering the labour market of people with specific features, such as persons with disabilities, but also the millennial youth, whose characteristics are very different from their parents' (of Generation X), or grandparents' (of the baby boomer generation). Without taking account of the characteristics of the modern employee, it is impossible to talk about a modern analysis of the labour market, and hence an analysis of workforce segmentation. This place is filled in by the model proposed in this paper (the horizontal axis).

Thus, the model places emphasis on the empowerment of the employee, who ceases to be "an organism on which economic procedures are performed", either by the employer (within a personnel policy), or the state (within the labour market policy). The modern labour market has changed over the last half century and its assessment through the prism of invariable statements and beliefs is misleading.

A dynamic approach (used in the model, as developed) works in practice much better; it is based on segmentation taking account of variable criteria depending on market conditions. The model also allows to grasp changes as they occur.

The situation is the more interesting that in the face of the indiscernible unemployment, wage increases and the generally positive mood in the labour market, there are still workforce segments in which low wages prevail, as well and other "secondary" factors analyzed in M.J. Piore and P.B. Doeringer's model, and the developed model. The improvement of the general situation in the labour market does not mean the same improvement for every market participant. Application of a wider (than in the classical concept of the dual labour market) spectrum of segmentation evaluation criteria enables presentation, as objectively as possible, of secondary workforce segments (called "ghettos" in the classical segment analysis). Also within the internal labour market, such notions are referred to as "glass ceiling", "glass walls" and "sticky floor" (Kalinowska-Nawrotek 2005). This means that the primary and secondary segments occur in the market in macro terms, but also in the trade and sector perspectives.

M.J. Piore and P.B. Doeringer noticed a strong influence of extra-economic factors in the labour market. In this aspect, their assumptions are coincident with – the model, as developed in this paper, takes into account a number of demographic, social and economic criteria and factors.

The author is aware that testing the model in banks only does not have a universal character, but rather a sectoral one. Nevertheless, there are a number of arguments in favour of such a course of action (Davydenko, Kaźmierczyk, Romashkina, Żelichowska 2017; Kaźmierczyk, Davydenko, Romashkina, Andrianova 2018; Kaźmierczyk, Chinalska 2018; Kaźmierczyk, Żelichowska 2017; Kaźmierczyk, Davydenko, Romashkina, Żelichowska 2017; Aptacy, Kaźmierczyk 2016; Kaźmierczyk 2014; Aktan, Turen, Tvaronaviciene, Celik, Alsadeh 2018).

The developed model is universal and can be applied in many sectors, not only in banking. In addition, M.J. Piore and P.B. Doeringer combined the primary labour market segments with "primary" enterprises, i.e. ones that produce goods or services which are in high demand. It can, obviously, be disputed whether banks belong to such a segment, still, at least within the traditional thinking, banks are so classified. It should be borne in mind, however, that the banking profession has pauperized, it is more easily available for people without specialist training and there is pressure for sale and specialization which, in combination, lead to routinization and accordization (Kaźmierczyk 2014).

In case of the dual labour market, analyses are carried out mainly from a demand-side point of view (Kryńska 2000), in the exactly the same way as in the developed model, asking bank employees' opinion. In M.J. Piore and P.B. Doeringer's model, the situation of a given employee tends to become fixed. People occupying better positions usually stay there for a long time and do not let others take their place. Furthermore, the stronger an employee's situation (in the model it is depicted by means of a larger number of personnel policy tools or perception of employment relationships, in which they classify themselves as the primary workforce segment), the more durable is his/her primary situation. It also has to do with the notion, as known in economics, of path dependency. A similar opinion is expressed by I. Bludnik (2014).

Positive qualities support each other, the same as negative ones loop and create unemployment, poverty and other "ghettos". The developed model, like the one by M.J. Piore and P.B. Doeringer (Barron, Norris 1976; Kryńska 2000) focuses mainly on the employee, however, it can also be used (following adaptation) to analyze unemployed people.

**Table 2.** Common and varying elements in the model by M.J. Piore and P.B. Doeringer and the model proposed in the paper

Assumptions and results in common for the model by M.J. Piore and P.B. Doeringer and the model developed in the paper	Results of the author's article supplementing the hitherto literature
Institutionalism as the starting point	Additional consideration for influences of behavioural economics, systemic approach and constructivism
Analysis of segmentation from the point of view of the employee	Additional consideration for the employer's situation
Generalization of conclusions concerning segmentation	Addition of the micro-, mezzo- and international perspective
Using specific labour market segmentation criteria (large enterprises, trade unions, job security, career development and promotion opportunity, career stability, high remuneration, strong identification with one's workplace)	Additional adoption for the analysis of a number of other criteria. The list of personnel policy instruments and perception of employment is open. (E.g., as noticed by E. Kryńska (2001) and A. Musiał-Paczowska (2002), labour market segmentation is connected with application of flexible forms of employment, which was included in developed model and analyzed empirically (Każmierczyk, Chinalska 2018).)
Taking account of a large influence of extra-economic factors	
Division of workforce into segments	The number of segments results from current market conditions
Separation of workforce segmentation criteria	Lack of presupposed set of criteria (the criteria depend on the objectives of the segmentation analysis)
Focus on the employee	(Following adaptation) ability/possibility to use the model with respect to unemployed people and people who are passive in the labour market

*Source:* author's own elaboration.

In case of M.J. Piore and P.B. Doeringer's model, one of the reasons for the occurrence of the primary and secondary labour market, was the willingness to use the latter by the former (Leszczyński 2008, p. 31). In the developed model, any antagonisms between market participants matter, but demographic and social variables are also important that characterize the employee, as well as economic variables characterizing the employer. To sum up, the assumptions and results of presented research are similar to M.J. Piore and P.B. Doeringer's studies, however, they deepen the hitherto output of economic literature (Table 2).

E. Kwiatkowski assesses that since 1970s, within economic studies on the labour market, analyses started with certain facts from the reality of the labour market, which were then used to create a theoretical model taking these facts into account, and then the model was confronted with reality, testing it on market data by means of statistical tools. He also adds that in this way economics departed from institutional specificity and became alike mainstream economics (2019, p. 5). Presented research, on the one hand, combines an approach similar to institutionalism (workforce segmentation in a manner being similar to M.J. Piore and P.B. Doeringer's), and, on the other follows closely the algorithm described by E. Kwiatkowski (Contradictions in the institutionalized and neoclassical approaches to the dual labour market are presented by M.L. Wachter (1974, p. 641)).

## Conclusions

The developed model of workforce segmentation allows for taking into account the basic classification of workforce due to the demographic and social features of employees and economic characteristics of employers. The model is universal and can be applied in many sectors, not only in banking. In addition, when analyzing these areas, it refers to groups of people for "primary" and "secondary" work sub-segments (regardless of how these sub-segments will be determined and how they will be separated). The developed model allows for a flexible definition of what is a primary and secondary sub-segment of employment, taking into account various personnel policy instruments and the perception of employment relationship.



Summing up, the most important arguments for the novelty of the analyses, as conducted, and, simultaneously, arguments for carrying out further comparative studies of workforce segmentation in banks with respect to selected personnel policy instruments and perception of employment relationships, include, as follows:

- possibility to draw in-depth and detailed conclusions regarding selected personnel policy instruments and perception of employment relationships,
- possibility to take account of the specificity of these instruments and the specific character of a country,
- possibility to analyze relations between personnel policy instruments and perception of employment relationships (without detriment to the accuracy of the analysis, one may simultaneously analyze broader connections between these areas within the sector),
- cognitive curiosity to analyze issues that have not undergone examination yet (also due to difficulties in accessing data concerning banks, in particular relating to the Russian banking sector),
- conviction that Asia (including Russia) and the other BRICS countries – Brazil, Russia, India, China and South Africa – are an interesting area which are offered an opportunity to develop dynamically in the future,
- the banking sector is one that has undergone turbulent changes, which favours observation of a number of diverse personnel processes,
- the banking sector is, at the same time, a leader in implementation of a number of organizational and personnel solutions, which enables later reference of the results to sectors where changes are only occurring now or will occur,
- the analysis of the two banking sectors being at different levels of development (the Polish and Russian ones) allows to forecast any workforce progress in banks, as well as, in practical terms, to optimize personnel processes.

The next stage of research should be the collection of the empirical results related to policy instructions and perception from employee relationship in order to determine the workforce segmentation segments in banks. In order to verify the developed model, the following are worth expanding:

- territorial scope, to include the another country (besides Poland and Russia);
- subjective scope:
  - use both employee self-evaluation and assessment made by employers,
  - carrying out the empirical research and obtaining results in other sectors of the economy, outside the financial sector;
- objective scope:
  - career path motivators,
  - individuals' freedom of choice,
  - comparison of the measurement results obtained (in empirical study) with results obtained through application of other tools,
  - additional areas of employment,
  - perception of personnel policy and its instruments (people managing organizations should be aware of the fact that employees evaluate whether the organization cares for their development, e.g. by means of training, application of adequate forms of employment, and, as a consequence, whether they become attached to it and stay with it for longer or, not feeling such attachment, look for other employment opportunities. Personnel PR should be of importance. In addition, managers should increase their employees' awareness within the personnel process, in order to shape pro-employee attitudes as a key element of the personnel strategy determining the competitive advantage in the labour market),
  - analysis of objectives, benefits and costs resulting from workforce segmentation from the point of view of the employee, employer and government;
- temporal scope – repetition of the research in 3-year cycles in order to seize the dynamics and impact of the business cycle.



## References

- Akhtar, Z.; Nadir, P.; & Nadir, H. 2016. Job Satisfaction and Job Involvement among Private and Government Bank Employees, *Indian Journal of Health & Wellbeing* 7(2): 236-239.
- Aktan, B.; Turen, S.; Tvaronaviciene, M.; Celik, S.; Alsadeh, H.A. 2018. Corporate governance and performance of the financial firms in Bahrain, *Polish Journal of Management Studies* 17(1): 39–58. <https://doi.org/10.17512/pjms.2018.17.1.04>
- Aptacy, M.; Kaźmierczyk, J. 2016. The management by objectives in banks: the Polish case, *Entrepreneurship and Sustainability Issues* 4 (2): 146-158. [http://dx.doi.org/10.9770/jesi.2016.4.2\(3\)](http://dx.doi.org/10.9770/jesi.2016.4.2(3))
- Bhati, S.S.; De Zoysa, A. 2013. Stages of trust development in banking relationship, *Banks and Bank Systems* 8(1): 36-44.
- Barron, R.D.; Norris, G.M. 1976. Sexual Division and the Dual Labour Market, in: Barker, D.L. Allen S. (Ed.). *Dependence and Exploitation in, Work and Marriage*. London-New York: Longman, 125-148.
- Baszyński, A. 2008. Działanie bankowego rynku pracy w Polsce na przełomie XX i XXI wieku [The operation of the banking labor market in Poland at the turn of the 20th and 21st centuries], in: Jarmołowicz, W. (Ed.). *Przemiany na współczesnym rynku [Transformations on the modern market]*. Poznań: Wydawnictwo Forum Naukowe, 195-223.
- Battisti, M. 2008. Reassessing Segmentation in the Italian Labour Market, *LUISS Dipartimento di Scienze economiche e aziendali, Quaderno* 149: 1-21.
- Bąk-Grabowska, D.; Jagoda, A. 2015. Flexibility of Workplace vs. Non-standard Employment Forms – Co-occurrence Analysis, *Journal of International Studies* 8(2): 130-138.
- Berger, S.; Piore, M.J. 1980. *Dualism and discontinuity in industrial society*, Cambridge: Cambridge University Press.
- Bludnik, I. 2014. Rynek pracy – perspektywa postkeynesowska [Labour Market – Post Keynesian Perspective], *Studia Oeconomica Posnaniensia* 2(7): 7-18.
- Cain, G.G. 1976. The Challenge of Segmented Labor Market Theories to Orthodox Theory: A Survey, *Journal of Economic Literature* 14 (4): 1215-1257.
- Davydenko, V.A.; Kaźmierczyk, J.; Romashkina G.F.; Żelichowska, E. 2017. Diversity of employee incentives from the perspective of banks employees in Poland - empirical approach, *Entrepreneurship and Sustainability Issues, Entrepreneurship and Sustainability Issues* 5(1): 116-126. [http://doi.org/10.9770/jesi.2017.5.1\(9\)](http://doi.org/10.9770/jesi.2017.5.1(9))
- Čiutienė, R.; & Petrauskas, P. 2012. Management by Objectives Using Coaching, *Economics & Management* 17 (4): 1559-1563.
- Elegido, J.M. 2013. Does it make sense to be a loyal employee?, *Journal of Business Ethics* 116 (3): 495-511.
- Fukuyama, F. 1996. *Trust: The Social Virtues and The Creation of Prosperity*, New York: Free Press.
- Fulk, H.K.; & Bell, R.L., Bodie, N. 2011. Team Management by Objectives: Enhancing Developing Teams' Performance, *Journal of Management Policy & Practice* 12 (3): 17-26.
- Garbat, M.; Paszkowicz, M.A. 2016. Niepełnosprawność jako przyczyna wykluczenia z rynku pracy [Disability as the cause of exclusion from the labor market], *Scientific Journal of the Polish Economic Society in Zielona Góra*, 4: 61-79.
- Garz, M. 2013. Labour Market Segmentation: Standard and Non-Standard Employment in Germany, *German Economic Review* 14(3): 349-371.
- Gębska, K. 2018. Labor market in the context of creating corporate value and intellectual capital in the process of selecting smart specializations, *Scientific Journal of the Polish Economic Society in Zielona Góra* 8: 56-66. <https://doi.org/10.26366/PTE.ZG.2018.123>

Golinowska, S. 2001. Teorie migracji a debata o swobodzie przeplywu pracowników w rozszerzonej Unii Europejskiej [Theories of migration and the debate on the freedom of movement of workers in the enlarged European Union], *Problemy polityki społecznej. Studia i dyskusje* [Problems of social policy. Studies and discussions] 3: 17-31.

Hajdin, M. 2005. Employee Loyalty: An examination, *Journal of Business Ethics* 59 (3): 259-280.

Heyes, J. 2011. Flexicurity, employment protection and the jobs crisis, *Work, Employment and Society* 25 (4): 642-657.

Jarmołowicz, W.; Kalinowska-Sufinowicz, B. 2012. Funkcjonowanie regionalnego rynku pracy (na przykładzie województwa wielkopolskiego w latach 2000–2010) [Functioning of the regional labor market (on the example of the Wielkopolskie voivodship in the years 2000-2010)], *Acta Universitatis Lodzensis, Folia Oeconomica* 268: 249-264.

Jarmołowicz, W.; & Knapieńska, M. 2011. Współczesne teorie rynku pracy a mobilność i przepływy pracowników w dobie globalizacji [Contemporary Labour Market Theories vs the Mobility and Movement of Employees in the Era of Globalization], *Scientific Journal of Polish Economic Society in Krakow* 9: 123-144.

Jaźwiński, I. (2017). *Kapitał ludzki w polityce regionalnej* [Human capital in regional policy]. Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.

Kalinowska-Nawrotek, B. 2005. *Dyskryminacja kobiet na polskim rynku pracy* [Discrimination against women on the Polish labor market], Poznań: Uniwersytetu Ekonomicznego w Poznaniu.

Kaźmierczyk, J. 2011. Grzechy ekonomii, czyli trzynaście problemów w rozważaniach ekonomistów (esej) [Sins of Economic Thought: Thirteen Issues in The Economists Considerations (Essay)], *Zeszyty Naukowe Ostrołęckiego Towarzystwa Naukowego im. Adama Chętnika* [The Journals of The Adam Chetnik Learned Society of Ostrołęka] XXV: 393-406.

Kaźmierczyk, J.; Chinalska, A. 2018. Flexible Forms of Employment, an Opportunity or a Curse for The Modern Economy? Case Study: Banks in Poland, *Entrepreneurship and Sustainability Issues* 6(2): 782-799. [http://doi.org/10.9770/jesi.2018.6.2\(21\)](http://doi.org/10.9770/jesi.2018.6.2(21))

Kaźmierczyk, J.; Davydenko, V.A., Romashkina, G.F., Andrianova, E.V. 2018. A Comparative Analysis of the Levels of Collective Trust among the Banking Staff in Poland and Russia, *Comparative Sociology* 17(3-4): 299-317. <http://doi.org/10.1163/15691330-12341462>

Kaźmierczyk, J.; Davydenko, V.; Romashkina, G.; Żelichowska, E. 2017. Diversity of Employee Incentives from The Perspective of Banks Employees in Poland – Empirical Approach, *Entrepreneurship and Sustainability Issues* 5(1): 116-126. [http://doi.org/10.9770/jesi.2017.5.1\(9\)](http://doi.org/10.9770/jesi.2017.5.1(9))

Kaźmierczyk, J.; Żelichowska, E. 2017. Satisfaction of Polish Bank Employees with Incentive Systems: An Empirical Approach, *The Baltic Region* 9(3): 58-86. <https://doi.org/10.5922/2079-8555-2017-3-5>

Kaźmierczyk, J. 2014. Centralizacja działalności jako czynnik zmniejszający jej regionalny charakter (przykład banków w Polsce) [Centralization of business as a factor of reducing its regional character (The Polish banks case)], *Zeszyty Naukowe Polskiego Towarzystwa Ekonomicznego w Zielonej Górze* [The Scientific Journal of the Polish Economic Society in Zielona Góra] 1: 119-132.

Kerr, C. 1977. *Labor Markets and Wage Determination. The Balkanization of labor Markets and Other Essays*, Berkeley-Los Angeles-London: University of California Press.

Kotliński, G. 2018. Consequences and determinantsofthe impact of innovationon the labor market in the area of financial intermediation and in banking, *Scientific Journal of the Polish Economic Society in Zielona Góra* 8: 83-96. <https://doi.org/10.26366/PTE.ZG.2018.125>

Kramer, R.M. 2010. Collective Trust within Organizations: Conceptual Foundations and Empirical Insights, *Corporate Reputation Review* 13(2): 82-97.

Kryńska, E. 1996. *Segmentacja rynku pracy. Podstawy teoretyczne i analiza statystyczna* [Segmentation of the labor market. Theoretical basics and statistical analysis], Łódź: Wydawnictwo Uniwersytetu Łódzkiego [Publisher of the University of Lodz].

Kryńska, E. 2000. Mobilność zasobów pracy w wybranych teoriach rynku pracy [Mobility of labor resources in selected theories of the labor market], in: Kryńska, E. (Ed.). *Mobilność zasobów pracy* [Mobility of labor resources]. Warsaw: IPiSS.

Kwiatkowski, E. 2019. *Kierunki i charakter badań w ekonomii pracy oraz jej relacje do dziedzin i dyscyplin naukowych* [Directions and nature of research in labor economics and its relations to fields and scientific disciplines], Retrieved from [www.pte.pl/pliki/2/1/PAN\\_PTE\\_E\\_Kwiatkowski\\_referat.pdf](http://www.pte.pl/pliki/2/1/PAN_PTE_E_Kwiatkowski_referat.pdf) (10.4.2019)

Leszczyński, M. 2008. Dostęp do rynku pracy w kontekście teorii segmentacyjnych [Access to the labor market in the context of segmented theory], *Acta Scientifica Academiae Ostroviensis* 38: 19-36.

Lewicki, R.J.; Tomlinson, E.C.; Gillespie, N. 2006. Models of interpersonal trust development: Theoretical approaches, empirical evidence and future directions, *Journal of Management* 32: 991-1022. <https://doi.org/10.1177/0149206306294405>

Loveridge, R.; Mok, A. 1980. Theoretical Approaches to Segmented Labour Markets, *International Journal of Social Economics* 7(7): 376-411.

Luhmann, N., 2012, *Introduction to Systems Theory*, Cambridge: Polity.

Lurie, Y.; & Frenkel, D.A. 2002. Mobility and loyalty in labour relations: An Israeli case, *Business Ethics: A European Review* 11(3): 295-301. <http://doi.org/10.1111/1467-8608.00287>

Mączyńska, E. 2011. Dysfunkcje gospodarki w kontekście ekonomii kryzysu [Dysfunctions of the economy in the context of crisis Economics], *Polskie Towarzystwo Ekonomiczne w Krakowie, Zeszyty Naukowe* [Polish Economic Society in Krakow, Scientific Journal] 9: 43-70.

Maniak, G. 2003. Zarządzanie zasobami ludzkimi w kontekście teorii rynku pracy [Human resource management in the context of labor market theory], in: Kopycińska, W. (Ed.). *Kapitał ludzki w gospodarce* [Human capital in the economy]. Szczecin: PTE, 53-67.

Musiał-Paczkowska, A. 2002. Wybrane aspekty elastyczności zatrudnienia [Selected aspects of employment flexibility], in: Urbańczyk, E. (Ed.). *Zarządzanie wartością przedsiębiorstwa – Teoria i praktyka* [Enterprise value management – Theory and practice]. Szczecin: KREOS.

Musiał-Paczkowska, A. 2003. Segmentacja rynku pracy [Segmentation of the labor market], in: Kopycińska, D. (Ed.). *Kapitał ludzki w gospodarce* [Human capital in the economy]. Szczecin: PWE, 69-87.

Osberg, L.; Apostle, R.; Clairmont, D. 1987. Segmented labour market and the estimation of wage function, *Applied Economics* 19(12): 1603-1624.

Osterman, P. 1987. Choice of Employment systems in Internal Labour Markets, *Industrial Relations* 26(1): 46-67.

Pająk, K.; Kamińska, B.; & Kvilinskyi, O. 2016. Modern trends of financial sector development under the virtual regionalization conditions, *Financial and Credit Activity: Problems of Theory and Practice* 2(21): 204-217. <https://doi.org/10.18371/fcaptp.v2i21.91052>

Paszkowicz, M.A. 2018. Osoby z niepełnosprawnościami jako wyzwanie dla rynku pracy [People with disability as a challenge for the labor market], in: Prüfer, P. (Ed.). *Niepełnosprawność a społeczeństwo. Teoria i praktyka* [Disability and society. Theory and practice], Gorzów Wielkopolski: Akademia im. Jakuba Paradyża w Gorzowie Wielkopolskim, 213-232.

Piasecki, P. 2018. Segmentacja zatrudnienia w bankach spółdzielczych w Polsce [Employment segmentation in cooperative banks in Poland], Warsaw: IPISS.

Pocztowski, A. 1993. Segmentacja rynku pracy [Segmentation of the labor market], *Zeszyty Naukowe AE w Krakowie* [Scientific Journal of AE in Krakow] 379: 19-28.

Polkowska, D. 2016. The "precarity trap" of Poland's youth labour market: flexible employment a barrier or opportunity?, *Employment and economy in Central and Eastern Europe* 1/2016: 1-16.

Puzio-Waławik, B. 2015. Regulacja rynku pracy – krytyczna analiza wybranych teorii [Regulation of the Labor Market: a Critical Analysis of Selected Theories], *Zeszyty Naukowe, Wyższa Szkoła Ekonomii i Informatyki w Krakowie* [Journal of the University of Economics and Computer Science in Krakow] 11: 133-156.

Reich, M.; Gordon, D.M.; Edwards, R.C. 1973. Dual Labor Market: A Theory of Labor Market Segmentation, *Economic Department Faculty Publications* 2: 358-365.

Seligman, A.B. 1997. *The Problem of Trust*, Princeton, New York: Princeton University Press.

Soniewicki, M. 2015. *The company's international competitive advantage – the role of knowledge*. Warsaw: Difin.

Szambelańczyk, J. 2001. Struktura rynku pracy jako determinanta zarządzania kadrami [Structure of the labor market as a determinant of human resources management], in: Urbaniak, B. (Ed.). *Gospodarowanie pracą [Work management]*. Łódź: Publisher of the University of Lodz, 123-133

Wachter, M.L. 1974. Primary and Secondary Labor Markets: A Critique of the Dual Approach, *Brookings Papers on Economic Activity* 3: 637-693.

Wąsowicz, J. 2007. Teorie rynku pracy [Theories of the labor market], in: Kotlarz, D. (Ed.). *Ekonomia rynku pracy [Economics of the labor market]*, *Prace naukowe, Katowice: AE w Katowicach [Research papers, Katowice: AE in Katowice]*, p. 56.

Wieczorek-Szymańska, A. 2015. Organizacja fraktalna w gospodarce sieciowej [The Fractal Organization in the New Economy], *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania [Studies and Works of the Faculty of Economic Sciences and Management]* 39 (1): 91-100. <https://doi.org/10.18276/sip.2015.39/1-08>

Wyrwa, J.; & Piątyśzek-Pych, A. 2012. Bezpieczny i elastyczny rynek pracy w Europie – idea koncepcji flexicurity [Safe and Flexible Labor Market in Europe – Idea of the Flexicurity Concept], *Problemy Profesjologii [Problems of Professology]* 1: 33-57.

Zawada, P. 2017. Aktywizacja osób młodych znajdujących się w najtrudniejszej sytuacji na rynku pracy w woj. podkarpackim – niewykorzystane zasoby i szanse [Activation of young people in the most difficult situation on the labor market in the Podkarpackie voivodship – lost resources and opportunities], *Zeszyty Naukowe WSEI seria: Ekonomia [Zeszyty Naukowe WSEI seria: Ekonomia]* 13-14 (1-2/2017): 7-23.

Zwiech, P. 2013. Nierówności społeczno-ekonomiczne w świetle teorii segmentacji rynku pracy [Socio-Economic Inequalities in the Context of Labour Market Segmentation Theory], *Ruch Prawniczy, Ekonomiczny i Socjologiczny [Legal, Economic and Sociological Movement]* LXXV – Vol. 2, p. 139-150.

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## CAUSES OF NON-PERFORMING LOANS: THE EXPERIENCE OF GULF COOPERATION COUNCIL COUNTRIES

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**Abstract.** As financial intermediaries and provider of financial services, banking sector plays a pivotal role in the development of any economy. Performance of loans in banks' portfolios is a critical issue for this sector. The purpose of this study is to examine the determinants of Non-Performing Loans in Gulf Cooperation Council region. This study investigates the significant factors determining the Non-Performing Loans in banking sector of this region taking into consideration bank specific as well as macroeconomic factors. Two step Generalized Method of Moments approach to study the relationship among the variables was used to examine the determinants of Non-Performing Loans in this region for a period from 2009 to 2015. Four different models employed as a result of the examination of the theories were used to observe and analyse the determinants of these non-performing loans. According to the findings of the model generated from the bad management hypothesis, Non-performing loans are a serious issue requiring due attention, and bank profitability measured by Return on Average Assets has significant and negative effect on Non-Performing Loans. This suggests that banks in this region have more incentive to increase return by using their assets and effectively managing the funds contributed by the shareholders respectively.

**Keywords:** Non-performing loans; GCC banking sector; Financial Stability

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### 1. Introduction

The banking sector plays an important role in the development of economy as they take deposits and lend to others. Banks give loans not only to individuals but to various sectors such as business and government which undertake investment and development activities. Therefore, the stability of the banking sector is an important issue of concern.



Banks have become very cautious in granting loans and advances because failure of repayment of loans on time as per the loan agreement or contract gives rise to a serious problem of non-performing loans (NPLs), or bad loans, which in turn affects the asset quality of the banks as major part of the banks' assets is comprised of loans. The decline in asset quality due to increase in NPLs leads to bank failure and thereby affecting the financial stability of the economy.

Although definition of NPLs for various countries may differ, according to IMF Compilation Guide of Financial Soundness Indicators, "non-performing loans are those whose repayments are past due for 90 days or more" (IMF, 2005).

Stability of the banks is a major concern because banks play a crucial role in the development of economy by mobilizing funds and hence bringing stability in the economy. Therefore, banks are required to have quality assets which helps them achieve better performance. Failure to establish banking stability commonly leads to crisis.

The global financial crisis of 2008 is illustrative of how bank instability can lead to the ruin of many financial institutions. Subsequently, Central banks have established financial stability units which are responsible to prepare financial stability reports (FSR) and notify about risks to the financial system.

Banking sector faces many significant challenges and hence come across many types of risks; one of them is counterparty risk which arises due to untimely repayment of loans by borrowers leading to NPLs. Rising NPLs can become a threat to the banking system. Consequently, it will become difficult for banks to repay the deposits on time.

Moreover, lending is the key role and major source of revenue for commercial banks, and thus the non-payment of the loans affects and damages the financial position of banks which in turn affects the banks' operations as these unrecoverable loans will be written off as non-performing thereafter. In short, NPLs are a drag for any bank, negatively affecting banks' profitability and undermining depositors' confidence.

There was evidence that banking crisis in East Asian countries were due to increasing number of NPLs in banks' loan portfolio. Therefore, there is a strong need for addressing the issue of NPLs by identifying and mitigating its causes. Causes of NPLs in different countries can vary due to different economic conditions.

Since financial institutions are instrumental for a country's economic growth and development, after 2008 crisis this issue has gained increased attention and relevant research has grown substantially. According to Demirgüç-Kunt and Huizinga (1999), there is statistically significant difference on interest margin and bank profitability between developing and industrial countries due to several institutional factors, such as indexes of credit rights, law and order, competitiveness, corruption, and differences in financial structure. In this case, it is reported that interest margin and bank profitability are higher in developing countries than industrial countries.

Many studies were carried out indicating different determinants of NPLs. The results of those studies were inconsistent which might be due to different methods of data analysis used and different economic condition of the countries. Thereby parallel to studies on determinants of NPLs globally, it's important to study the case of focused work, as in this paper, on the banking sector of Gulf Cooperation Council (GCC) region, comprising six countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

The development and expansion of the economies of GCC countries has led to quick development of financial sector which has resulted in very high rate of growth in supplying credit to the customers. The determinants of NPLs can be different for the banks operating in the GCC due to different economic, social and political conditions, which is important for enhancing the quality of assets and the deterioration in bank assets quality and to prevent bank failure. That is the purpose of this paper focused on the banking sector in GCC.



## **2. Literature Review**

The importance of banking system and financial stability in the development of an economy is well-recognized. Stable banking system is indispensable for facilitating economic development.

Financial institutions provide funds and help industries to carry out projects in economy as well as support investment activities. Banks face many risks while granting loans; one of the risks is the default risk due to non-payment of the loans which results in NPLs. High levels of NPLs adversely affect the asset quality, subsequently affecting the performance of the banks. This leads to financial loss of the banks and thereby affecting the financial stability of the economy. To bring about the stability, banks are required to have quality assets for better performance.

Banking system stability is being impacted by both internal factors i.e. bank specific and external factors i.e. macroeconomic (Ashraf et al. 2018; Masood et al. 2019). It is very important for policy makers and regulators to understand the drivers of high level of NPLs in the banks in order to come up with preventive measures. The management should also have good understanding of NPLs to help allocate resources efficiently. Forecasting and stress testing undertaken by bank management can be made better if research is based on identification of specific factors playing important role in increasing the level of NPLs.

Several studies done in different countries by researchers such as Salas and Saurina (2002), Williams (2004), Messai and Jouini (2013), etc., have identified the following factors as determinants of NPLs: inflation rate, unemployment, level of GDP, ROA, ROE, liquidity, capital adequacy, bank size, volume of deposits and interest rates..

Bank profitability is affected by NPLs as they influence revenues as well as expenses. High level of NPLs means it's not performing and not bringing the interest income and hence low profit. Moreover, high NPLs leads to high provisions as well as high expenses involved in recovery process like administrative costs etc., hence reducing profit.

Low profit due to high NPLs leads to low retained earnings which influences capital adequacy ratio unfavourably. As NPLs are part of total assets, the risk connected with them leads to increase in total risk weighted assets which in turn lowers the capital adequacy ratio if the capital funds remain the same.

Low profit due to NPLs also reduces cash inflows giving rise to liquidity problem. This affects banks' ability in expanding loan portfolio. At the macroeconomic level, banks' reluctance to grant loans leads to credit contraction in the economy.

High NPLs indicates weakness in the bank asset quality. Investors perceive such assets to be of high risk and hence this generally brings down stock prices of the banks. Financial performance of the banks can decrease due to NPLs' adverse effects on interest income, high expenses, high provisioning requirement and difficulty in raising funds from the market. All this will influence share prices of the banks. Furthermore, if the banks whose asset quality is weak are helped by the government through capital infusion, this may also deteriorate fiscal position of the government. Thus, rising level of NPLs raises fear and high concern for not recovering the credit on time; therefore it is important to know about the causes and determinants which give rise to NPLs.

Studies to deal with these aspects with a focus on GCC countries is relevant because of the robust development and expansion of economies of countries in this region as well as the development and expansion of Islamic banks facilitating credit expansion. Previous researches on this topic show inconsistent results due to different causes of NPLs in different countries under different economic conditions. As far as GCC is concerned, not many studies on NPLs have been conducted.

In the recent past, NPLs have received greater attention. Poor management of the loans and cost control give rise to NPLs as discussed by Berger and DeYoung (1997). Many banks are not able to generate profits due to these

bad loans and thus risk their survival. Not only profitability but also liquidity, which is important for overall efficiency of banks, is affected by NPLs. Tesfaye (2012) stated that mismatch between maturities of asset and liability give rise to liquidity risk.

Many studies have been done before to know about the factors affecting the loan quality. Bank loans specifically NPLs were studied because of its importance in failure of banks. Some studies were done on single countries while others took into account group of countries. Whereas some studies only considered bank level factors while others only macro level factors. Below we provide a review of more specific aspects of the literature review.

## **2.1 Bank Specific Factors**

A number of studies demonstrated that micro level factors that are the bank specific factors are significant in influencing the NPLs:

Berger and DeYoung (1997) did research on commercial banks in the US for the period from 1985 to 1994 and proposed the following:

1. **Bad luck hypothesis:** higher operating costs lead to higher NPLs as more cost is associated with administering and monitoring bad loans as well as collateral recognition.
2. **Bad management hypothesis:** low operational efficiency because of poor credit monitoring give rise to NPLs.
3. **Skimping Hypothesis:** less cost can make the bank look cost efficient in the short run and can give rise to high NPLs in future.
4. **Moral Hazard Incentives:** Moral hazard is more likely to occur in the banks with low capital. This increases risks in loan portfolio and therefore increases NPLs.

Profitability is a key bank specific factor of NPLs. Return on assets, return on equity and net interest margin are assumed to be negatively related to NPLs. Godlewski (2005), Louzis et al. (2012) and Klein (2013) stated that the profitability of a bank has a negative impact on NPLs. However, it is expected that profit-maximizing policies will give rise to higher risk which may induce high NPLs.

According to Makri et al. (2014), who did a study on Eurozone banking system for a period 2000 to 2008, found out that ROA did not have significant effect on NPLs which was in contrast to Boudriga et al. (2009) who did a study in MENA region on problematic loans and observed that ROA has significant negative impact on NPLs.

The inefficiency of a bank is also an important bank-specific factor of NPLs. Berger and DeYoung (1997) expressed that inefficiency leads to higher NPLs because of poor monitoring of loans, cost control and also poor loan underwriting. Likewise, Williams (2004), Espinoza and Prasad (2010), Louzis et al. (2012), Aktan et al. (2018), Fakhry et al. (2018) also found supportive results.

Rossi, Schwaiger, and Winkler (2005) did research for the period from 1995 to 2002 on east and central European countries and stated that low efficiency can be associated with uncontrollable external factors.

Not much literature is available regarding the effect of the recent financial crisis. Dietrich and Wanzenried (2011) examined bank profitability of commercial banks in Switzerland for the period from 1999 to 2009 and found that loan loss provision did not significantly affect the performance of the bank before crisis, even though loan loss provisions increased during crisis.

According to Ezeoha (2011) who did study on banks in Nigeria reported that liquidity and equity capital made the asset quality worse whereas profitability, credit expansion improved the performance of banks.

Ahmad and Ariff (2007) expressed that NPLs and regulatory capital have positive relationship; hence banks should increase capital as a cushion against potential losses due to increase in credit risk.

Salas and Saurina (2002) and Louzis et al. (2012) found a negative relationship between bank size and NPLs and stated that bigger size of the bank enables more diversification opportunities.

Bank ownership is yet another important determinant of NPLs. Zribi and Boujelbene (2011) expressed that state banks have higher NPLs because they may have to finance the risky projects.

## **2.2 Macro Level Factors**

Some studies were done in order to understand changes in asset quality due to NPLs taking into consideration the macro-economic factors.

The real GDP is one of the key factors of NPLs and it is expected to be negatively related to NPLs. Dash and Kabra (2010), Bofondi and Ropele (2011), Klein (2013) and Jiménez et al. (2006), stated a negative relationship between GDP and NPLs. However, there are some studies that show a positive relationship between GDP and NPLs such as the one conducted by Saba et al. (2012) as cited by Islamoğlu (2015) and Demirgüç and Huizinga (1999) who determined that real GDP per capital had positive and significant relationship with NPLs.

Bock and Demyanets (2012) stated that NPLs affect the economy by slowing economic growth. Similarly, Jiménez et al. (2006) did a study and determined that in the period of economic expansion, companies earn high profits and also people have more income which leads to low level of NPLs. They also stated that NPLs affect profitability and capital adequacy of the banks negatively which in turn affect lending ability of banks. Therefore, the tightening of bank credit will decrease the investments in the economy.

Bofondi and Ropele's (2011) research on Italy and Saba's et al. (2012) research on US banking sector found that lending rate has negative relationship with NPLs.

According to Klein (2013) NPLs increase unemployment rate which is in contrast with Bofondi and Ropele (2011) who expressed that unemployment rate has negative effect on bank loan quality.

Amediku (2006) as cited by Alhassan, et al. (2014) did a study on banks in Ghana and used data from the year 1995 to 2005. He found out that nonperforming loans increased due to inflation.

In the same way, Saba et al. (2012) as cited by Islamoğlu (2015) did research on US banking sector to find out the determinants of non-performing loans. It was noted that inflation had positively significant effect with NPLs. Likewise, Klein (2013) expressed that inflation is positively related to NPLs.

Abid et al. (2014) did research and found that lower inflation rate has a positive influence on the financial conditions of debtors and eventually on the repayment of loans showing positive relationship between the inflation rate and NPLs.

According to Salas and Saurina (2002) and Jiménez et al. (2006), when there is a slowdown in the economy, NPLs will increase when unemployment rate rises and borrowers face difficulties in repaying the debt.

Amediku (2006) reported that in an economic boom as unemployment decreases, the real wages increase and so the purchasing power of households also increases, resulting in increase of the consumer demand and thereby increasing the need for credit.

Bock and Demyanets (2012) stated that high NPLs lead to exchange rate depreciation. Klein (2013) also determined that NPLs result in depreciation of exchange rate. Furthermore, Chaibi and Ftiti (2015) asserted that depreciation of the local currency may result in higher NPLs.

Moreover, many cross-country studies were also done. For example, study done in emerging market economies by Bock and Demyanets (2012) and GCC countries by Espinoza and Prasad (2010). Besides, specific countries studies were done such as the one by Quagliariello (2007) who did research on banks in Italy.

Hoggarth et al.'s (2005) work as cited by Quagliariello (2007) examined loan quality of UK banks using stress test and VAR technique and discovered that inflation rate and interest rates affect adversely the asset quality of banks by taking into account loan losses.

Quagliariello's (2007) research on Italian banks found that quality of bank loans deteriorates highly during recession period, while it improves during expansion.

Gerlach et al. (2005) did a study on Hong Kong in order to explain the trends of NPL ratio using regression analysis and found that NPL ratio increases with increase in nominal interest rates but decreases with higher CPI inflation, property price inflation and economic growth.

As cited by Vatansever and Hepşen (2013), Jakubik's (2007) research found that in Czech's corporate sector, NPL rate was positively affected by increase in real exchange rate, loan to GDP ratio, interest rate and unemployment rate.

Abid et al. (2014) did a study on Tunisian banks over a period from 2003 to 2012 and determined that household's NPLs are not only affected by macroeconomic factors such as GDP, interest rate and inflation rate but also by bad management quality.

Demirgüç and Huizinga (1999) found a positive relationship between GDP growth, inflation and bank performance, whereas negative between tax burden and performance.

### **2.3 Combined Factors**

There were some studies done which included both internal and external factors in order to have broad understanding of NPLs. Most of the studies used macro-economic factors as control variables.

Salas and Saurina (2002) did a study on banks in Spain. They investigated the determinants of NPLs for two types of banks, savings and commercial, and found that for savings banks GDP, inefficiency, non-collateralized loans, net interest margins affected the NPLs. Whereas for commercial banks, other factors affected NPLs like bank size, capital ratio and branch expansion, they concluded that micro factors, i.e. bank level factors, were significantly influencing factors for savings banks.

Quagliariello (2007) did a study on 200 banks in Italy for the period from 1985 to 2002 and concluded that internal factors such as efficiency, riskiness (interest income to total assets), slow credit growth and also external factors such as GDP, interest rates effects NPLs and loan provisioning.

Espinoza and Prasad (2010) investigated 80 banks in GCC countries for the period from 1995 to 2008 and concluded that non-oil GDP growth decreases NPL, whereas interest rate and risk aversion due to tight global financial situation increases NPL. They also discovered that capital size, credit growth and efficiency also impact NPL.

Klein (2013) investigated the causes of NPLs and found out excessive lending, profitability, bank equity, inflation, and unemployment affect NPLs.

Salas and Saurina (2002) did research in banks in Spain and investigated that economic growth, bank size, efficiency, interest spreads are the major factors affecting the problem loans.

Louzis et al. (2010) did a study on determinants of non-performing loans in Greek financial sector and found out that ROA, ROE and real GDP had negative whereas inflation rate, lending rate and unemployment had positive significant effect and capital adequacy ratio and loan to deposit ratio had insignificant effect on NPLs.

Swamy (2012) studied determinants of NPLs in Indian banking sector and found capital adequacy, GDP growth rate, inflation and lending rate have insignificant effect.

Messai and Jouini (2013) did a study on 85 banks in Greece, Italy and Spain for a period from 2004 to 2008 and observed that problematic loans vary negatively with ROA, growth rate of GDP and positively with real interest rate, unemployment rate and loan loss reserves to total loans.

Dhar and Bakshi (2015) did a research on Indian public banking sector for the period from 2001 to 2005 and found that net interest margin and capital adequacy ratio have negative significant effect on gross non-performing advances (GNPA), while sensitive sector comprised of commodity, capital market and commercial real estate have a statistically positive significant impact on GNPA.

Ali and Daly (2010) studied the impact of aggregate defaults on capital stock of the bank in USA and Australia and reported that US economy is more vulnerable to adverse effects of macroeconomic shocks and NPL ratio is positively related to sovereign debt.

### 3. Preliminary Analysis: NPLs Trends in GCC Countries

The banks in the GCC countries have become more vulnerable to varying degrees due to global crisis (Espinoza and Prasad, 2010). They had experienced significant credit expansion before 2008. The favourable macroeconomic factors also played a role in credit creation and lower levels of NPLs. But in the year 2009, a sharp increase was noticed in NPLs and credit grant slowed down. NPLs previously had reached very high levels in the GCC as well. This raised concern that the recovery of outstanding loan will be difficult and therefore this draws attention towards a thorough investigation for the factors that affect NPLs in these countries.

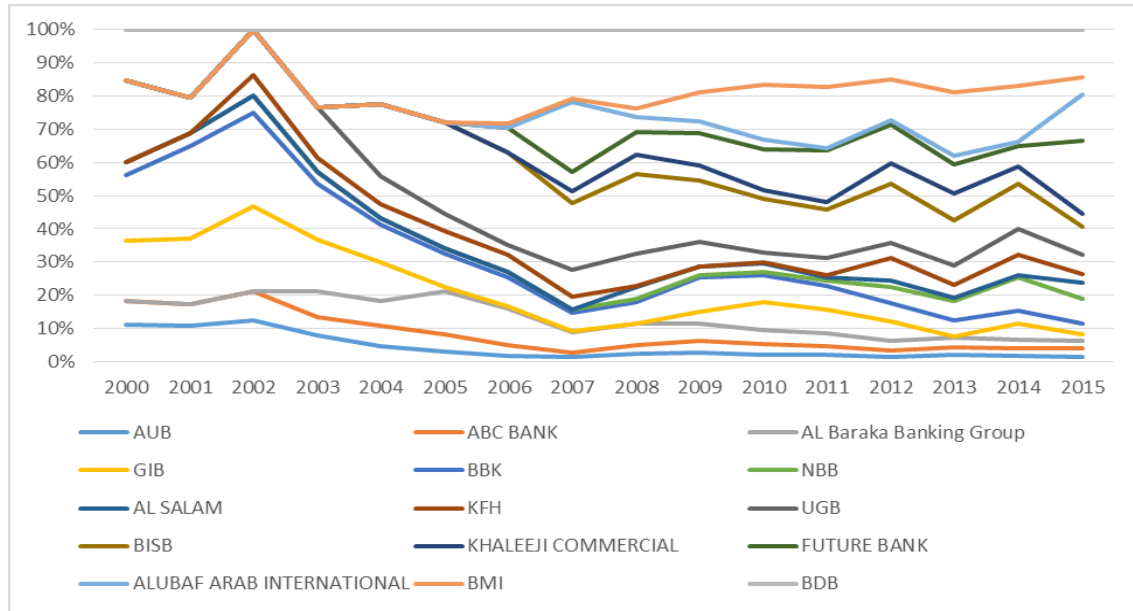
Based on Bankscope database covering around 75 banks, the following table presents the summary statistics of NPL ratio and it can be noticed that NPL ratio in GCC countries has increased after the global crises and this could adversely affect the credit risk.

**Table 1.** The summary statistics of NPLs in GCC Countries

	Bahrain	KSA	Kuwait	Oman	UAE	Qatar
No. of banks	15	11	11	7	20	11
NPL ratio in 2000-2007 (average)	5.96	2.93	3.83	11.35	4.68	4.58
NPL ratio in 2008 (average)	5.16	1.36	4.1	6.55	2.42	2.45
NPL ratio in 2009 (average)	6.07	2.61	3.96	7.26	4.75	4.68
NPL ratio in 2015 (average)	6.45	2.62	4.00	6.70	5.00	4.69

*Source: Bankscope Database*

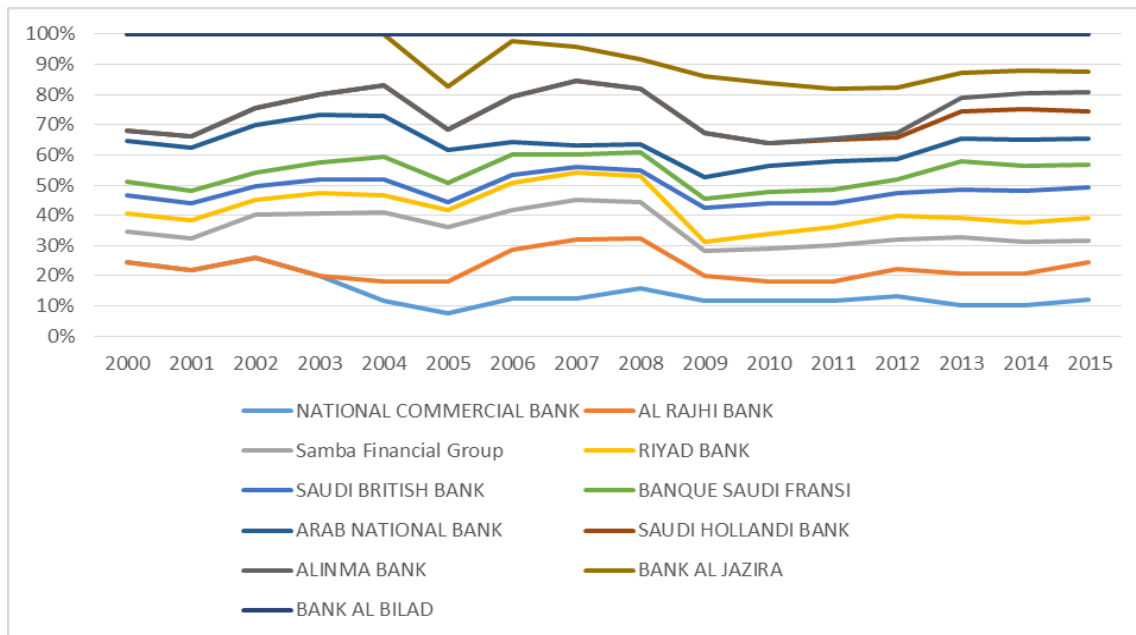
As can be seen from the figure 1 given below that the NPL ratio of commercial banks in Bahrain was quite high in early 2000s. Slowly and gradually it decreased. However it again increased during financial crisis which started in USA due to the collapse of subprime mortgage market in year 2007. The NPL ratio started to fall in 2010 and 2011 on average. But it increased again in 2012. It declined in the year 2013 and again rose in 2014. While in 2015, NPL ratio for most of the banks did not decrease much.



**Fig.1** NPLs to Gross loans – Bahrain

Source: Bank Scope Database

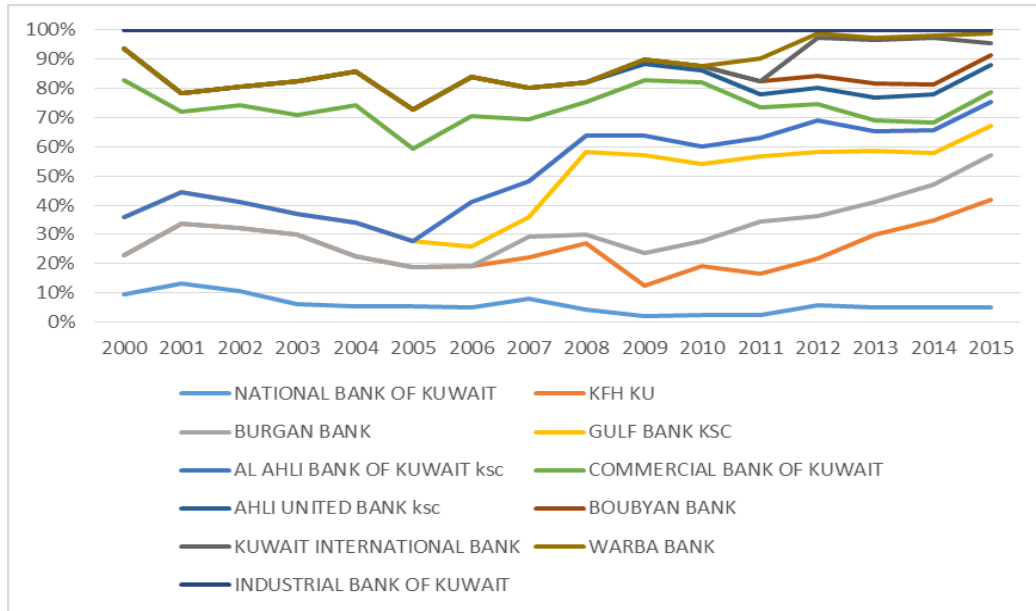
The NPL ratio for banks in Saudi Arabia was moderate in 2000 and 2001 as can be seen in figure 2. It slightly increased in the coming years and had sudden decrease in 2005. But again it started to increase and reached the peak in 2007. It slowly and gradually came down and started to rise again in 2010 and 2011. Then it became steady in 2012 till 2015.



**Fig.2** NPLs to Gross loans – Saudi Arabia

Source: Bank Scope Database

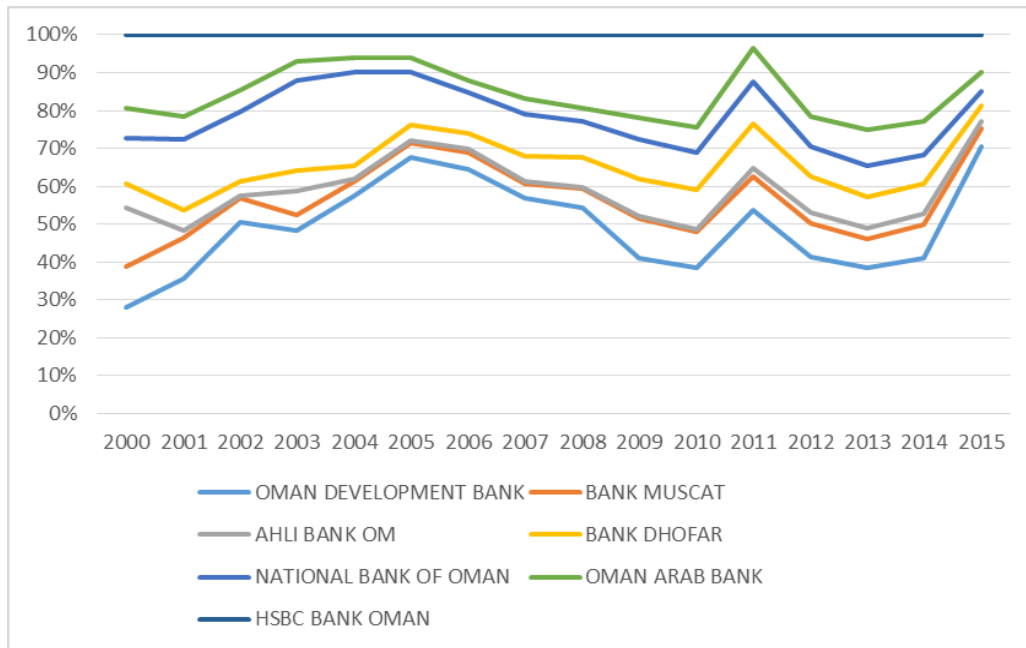




**Fig.3** NPLs to Gross loans - Kuwait

Source: Bank Scope Database

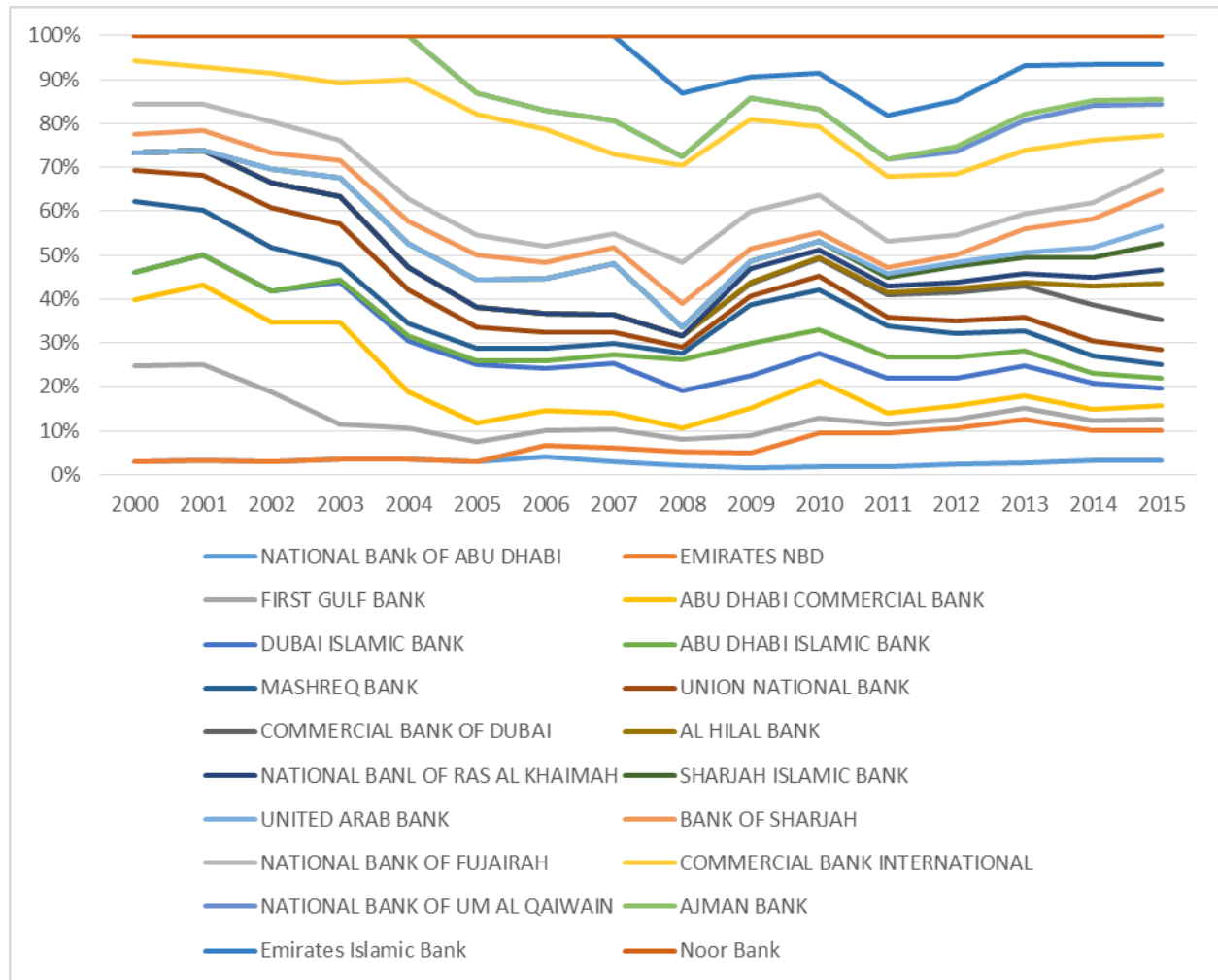
As shown in figure 3, the NPL ratio for Kuwaiti banks was low in early 2000s for most of the banks. Then it became somewhat steady. In 2005, NPL ratio declined for most of the banks. But it started to increase sharply from 2007 till 2008. A little decrease was noted in 2009 but then it started to increase again and had high NPLs in the year 2015.



**Fig.4** NPLs to Gross loans - Oman

Source: Bank Scope Database

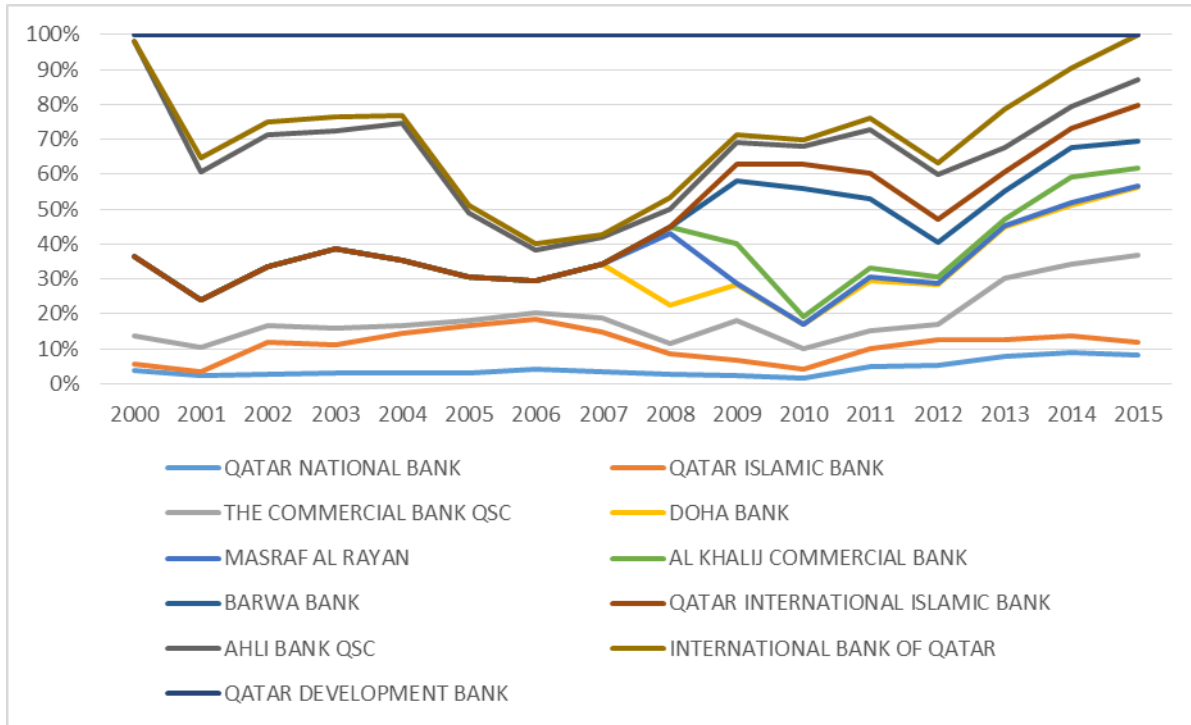
It can be noted from figure 4, the NPL ratio for Omani banks started to increase from the year 2001 reaching the peak in 2005. Thereafter it started to decrease till the year 2009. Whereas in 2010, a sudden increase was observed reaching the highest point in the year 2011 and thereafter it started to decrease soon after. But increased again the year 2014 and remained high in the year 2015.



**Fig.5** NPLs to Gross loans - UAE

Source: Bank Scope Database

As can be seen from the figure 5 given above, the NPL ratio for UAE banks started coming down in the year 2001 but increased in the year 2007, for a few banks it decreased in 2008 but then during the post crisis period, the NPL ratio increased for all the banks and remained high till the year 2015.



**Fig.6** NPLs to Gross loans - Qatar

Source: Bank Scope Database

From the figure 6, for Qatar the NPL ratio for some commercial banks was quite high in 2000. It decreased suddenly in the year 2001. It started to increase from 2001 and slight fluctuations were seen till year 2009. In post crisis period, the NPL ratio increased for most of the commercial banks which decreased in 2012 but then later rose again from 2012 and remained high till 2015.

#### 4. Data, Theoretical Framework and Methodology

##### 4.1 Data

This study investigates and explains the relationship between NPLs and its determinants. Explanatory and quantitative research approach have been used in accordance with empirical literature. The study covers 66 commercial banks whether Islamic or conventional in GCC region using purposive sampling technique. These banks were selected on the basis that they operated before, during and after the global financial crises and according to the data availability. The list of the banks can be referred to in Appendix I.

The secondary source of data was used for this study which was efficient. The cross-country bank level data was collected from the financial database Bank Scope for 6 countries in the GCC region for the period from 2009 to 2015. Data for the internal factors, i.e. bank specific factors, were obtained from it. Moreover, the database of International Monetary Fund's World Economic Outlook was also considered for external, macroeconomic factors.

To determine the factors affecting NPLs in the GCC countries and thoroughly investigate the empirical relationship between these factors and NPLs the following variables were taken into consideration because from the previous studies and literature such as the work of Boudriga et al. (2009), Espinoza and Prasad (2010), Ali and Daly (2010), Bofondi and Ropele (2011), Bock and Demyanets (2012), Klein (2013), Makri et al. (2014), Abid et

al. (2014), Dhar and Bakshi (2015) to name a few, which are the among the most important variables affecting the NPLs.

For the purpose of this study, as defined in the literature, non-performing loans are the bad loans which are outstanding for a long time as per the contract of loan. According to Tesfaye (2012), any loan which is not repaid timely in accordance to the loan agreement is known as non-performing.

Most of the independent variables are taken from previous studies.

Return on Average Assets (ROAA) represents efficiency in using assets. It shows how much net income is produced out of assets. The higher the ratio, the better. High ROAA may be because of high lending rates of banks and fees that increase bank profitability and size. Different studies concluded different results. Makri et al. (2014) found positive relationship between NPL ROAA. Whereas Messai and Jouini (2013) found negative relationship between them, suggesting that fall in profitability ratio leads to risky activities taken by banks which raise NPL level.

Return on Average Equity (ROAE) represents return rate from equity invested in banks. It shows how much net income is generated with amount invested by shareholders. Makri et al. (2014) found negative relationship between ROAE and NPL.

The size of the banks is represented by the banks' assets. Larger size may mean high profitability, efficiency and diversification. However, the large growth of the bank may have opposite effect: less efficiency and high risk.

Efficiency is used for quality of management in the literature. Management quality is crucial in the success of the firms in the long run. If the quality is poor, it will affect banks credit decisions and monitoring borrowers. It is calculated by cost to income ratio. If the ratio is high then it means operating efficiency is low thus leading to high level of NPL.

The increase in the price level is called inflation resulting decline in purchasing power of money. From literature review, it is noted that as inflation increases, the cost of borrowing becomes expensive and hence having adverse effect on quality of loan portfolio.

The GDP annual growth percentage represents the ratio indicating all final goods and services produced in a year. It shows the health of economy. If the economy is doing poorly, then firms will have lower profits.

**Table 2** Bank Specific Factors

Bank Level Factors	Definitions
ROAA	Net income/ average assets
ROAE	Net income/ average equity
SIZE	Natural Log of total assets
COSTEFF	Cost to income ratio

**Table 3** Macroeconomic Factors

Macroeconomic Factors	Definitions
INFLR	Inflation rate, GDP deflator %
GDP	Gross domestic product annual growth %

Due to different legislations, rules and policies NPLs can be different. In GCC region, non-performing loans are the loans which are not paid for ninety days or more. As the dependent variable, NPL ratio is measured by

nonperforming loans to gross loans. The dependent variable and explanatory variables covers the time period from the year 2009 to year 2015. Total of 462 observations were collected.

**Table 4** Summary Statistics of NPL ratio

Mean	5.214113
Maximum	30.330
Minimum	0
Std. Dev.	5.605544
Jarque-Bera	664.8954
Probability	0
Observations	462

## 4.2 Theoretical Framework

The study of Berger and DeYoung (1997) has important place in investigating sufficient factors of NPL ratio. The bad management hypothesis is mentioned is relevant in this context. According to this hypothesis, NPL ratio is affected by managerial quality. This interaction has been examined with the model given below.

$$NPL_{it} = a_0 + a_i B_{i,t} + a_i M_{i,t} + \varepsilon_{i,t} \quad (1)$$

In this model, NPL symbolizes non-performing loans that are the bad loans which are outstanding for a long time as per the contract of loan. B symbolizes bad management factors which are return on asset and return on equity in this study. The last one, M symbolizes macroeconomic factors. Furthermore, the asset size hypothesis which explains the NPL ratio, similar to the bad management hypothesis, was introduced by Salas and Saurina (2002). According to this theory, the size of the banks negatively affects the NPL ratio. The model based on this theory is given below.

$$NPL_{it} = a_0 + a_i S_{i,t} + a_i M_{i,t} + \varepsilon_{i,t} \quad (2)$$

In model 2, only S factor is different from the model 1 and this factor symbolizes asset size. It is assumed that the increase in costs in the bad luck hypothesis affects the NPL.

$$NPL_{it} = a_0 + a_i C_{i,t} + a_i M_{i,t} + \varepsilon_{i,t} \quad (3)$$

C represents cost efficiency in the bad luck hypothesis. In addition, the following model can be established by combining the hypothesis of bad management, bad luck and asset size.

$$NPL_{it} = a_0 + a_i B_{i,t} + a_i C_{i,t} + a_i S_{i,t} + a_i M_{i,t} + \varepsilon_{i,t} \quad (4)$$

## 4.3 Methodology

This study used both explanatory and econometrics analysis based on panel data from the year 2009 to 2015 to investigate the relationship between NPLs and its determining factors of commercial banks in GCC region. Data was analyzed by GMM (Generalized Method of Moments) regression.

Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) developed model GMM-system approach that solves the inwardness problem and can be applied to samples with  $T < N$  characteristics. This method is basically instrumental variable method. Variables thought to carry the problem of endogenous are not used. Instead of using endogenous variables, instrumental variables with similar moment properties are generated and instrumental variables are used in the regression model. The GMM beta estimator for the mentioned model is expressed in the following equation.

$$\hat{\beta}_{GMM} = (X'Z'WZ'X)^{-1} X'Z'WZ'y \quad (5)$$

In this model, X, y, Z, symbolize the independent variable matrix, dependent variable matrix and the symmetric weight matrix, respectively.

## 5. Findings and Analysis

To study and analyze the effects of macroeconomic and bank specific factors on non-performing loans as well as to know the significance of the model being estimated and the significance of each independent variable affecting NPL ratio, GMM system approach was run.

**Table 5** GMM Two Step System Approach Results

Variables	Model 1	Model 2	Model 3	Model 4
NPL(-1)	.8553142 (0.000)	.8721844 (0.000)	.8697022 (0.000)	.7931867 (0.000)
ROAA	-1.45891 (0.000)			-1.37365 (0.000)
ROAE	.0170012 (0.167)			.0101861 (0.165)
SIZE		-1.04316 (0.000)		-.650243 (0.000)
COSTEFF			.0691976 (0.000)	.0023734 (0.386)
GDP	.0406736 (0.000)	.0059461 (0.142)	.0063091 (0.159)	.049294 (0.000)
INF	.0049897 (0.003)	-.008355 (0.000)	.0035226 (0.013)	-.001866 (0.131)
CONSTANT	2.471483 (0.000)	10.42978 (0.000)	-2.43236 (0.000)	8.70349 (0.000)
Wald Test	90140.98 (0.000)	70735.98 (0.000)	137200.1 (0.000)	942302.7 (0.000)
Sargan Test	54.66178 (0.4112)	54.10811 (0.4319)	55.37874 (0.3850)	62.45677 (0.8058)
AR(2)	.31045 (0.7562)	.33794 (0.7354)	.16798 (0.8666)	.25224 (0.8009)

*Notes:* P-values are reported in parenthesis.



Models 1, 2, 3 and 4 represent bad management, asset size, bad luck and combined theories, respectively. All the models are statistically significant and it can be seen that there is also no endogeneity problem with the results of the Sargan test. No auto correlation problem was found in the models. Only variables ROAA and SIZE are statistically significant in all of the models in which they are used. Also, ROAA and SIZE are significantly negatively related to NPLs. Inflation only differs from model to model in terms of positive and negative effects.

## **Conclusions**

The purpose of this study was to examine the determinants of NPLs in GCC region for a period from 2009 to 2015. The data was analyzed by using two step GMM approach to know the relationship that exists between dependent and independent variables in the models.

The trend analysis of NPL ratio for GCC countries showed that NPLs rate was more in the early 2000s which slowly and gradually decreased and then suddenly increased in the post global financial crisis period and remained high till the year 2015. Four different models employed as a result of the examination of the theories were used to observe the determinants of NPLs. According to the findings of the model generated from the bad management hypothesis, bank profitability measured by ROAA has significant and negative effect on NPLs. In the same model, macroeconomic factors have statistically significant and positive effect on NPLs. Statistically significant and negative effects of bank size and inflation were observed in the model which regarded asset size of banks. In the third model, the bad luck hypothesis output showed that COSTEFF is significantly negatively related to NPLs. The combined model was created using the variables in all other models. In combined model, bank profitability measured by ROAA has significant and negative effect on NPLs. This suggests that banks in GCC region tend more to increase return by using their assets and effectively managing the funds contributed by the shareholders respectively. The cost to income ratio is positively related to NPLs meaning that more cost efficiency will lead to less NPLs. The inflation rate is negatively related to NPLs. This suggests that rise in the inflation will lead to less borrowing and hence less NPLs.

Based on the findings and results, it is recommended that NPLs are a serious issue which should be given due attention. Management of the bank should carefully assess the asset quality, represented by NPLs, which influences the bank performance and financial stability of the economy. The basic function of banks is to accept deposits and lend those deposits not only for short time but also for long time such as for government, businesses and housing etc. Delay in loan repayment will make it more difficult in obtaining further credit. The management should efficiently utilize the current assets because short term loans and advances are runnable meaning that anytime they can be demanded back by the creditors. Bank management has to monitor credit lending policies and do better client profiling not just looking at the financial condition but also their consumption behaviour. Bank management should also provide consultation services to borrowers in order to help them using loans wisely and communicate with them regularly in order to know their repayment ability or any change therein.

Bank management should implement efficient receivable management strategy to collect from borrowers on time. This will also help depositors and investors in boosting their confidence in banking industry and therefore improving efficient resource distribution procedure, which will also assist in sustainable growth of economic activities of the countries.

## References

- Abid, L., Ouertani, M. & Zouari-Ghorbel, S. 2014. Macroeconomic and Bank-Specific Determinants of Household's Non-Performing Loans in Tunisia: A Dynamic Panel Data, *Procedia Economics and Finance*, 13: 58-68. [https://doi.org/10.1016/S2212-5671\(14\)00430-4](https://doi.org/10.1016/S2212-5671(14)00430-4)
- Aktan, B., Turen, S., Tvaronaviciene, M., Celik, S., Alsadeh, H.A. 2018. Corporate governance and performance of the financial firms in Bahrain, *Polish Journal of Management Studies* 17(1): 39–58. <https://doi.org/10.17512/pjms.2018.17.1.04>
- Ahmad, N. & Ariff, M. 2007. Multi-country study of bank credit risk determinants, *International Journal of Banking and Finance* 5(1): 135-152, Retrieved from <http://ijbf.uum.edu.my/images/pdf/5no1ijbf/6ijbf51.pdf>
- Alhassan, A., Brobbey, F. & Asamoah, M. 2013. Does Asset Quality Persist on Bank Lending Behavior? Empirical Evidence from Ghana, *Global Journal of Management and Business Research Finance* 13(4): 1-8, Retrieved from <https://core.ac.uk/download/pdf/19903462.pdf>
- Alhassan, A., Keyreboah-Coleman, A. & Andoh, C. 2014. Asset Quality in a Crisis Period: An Empirical examination of Ghanaian Banks, *Review of Development Finance* 4(1): 50-62. <https://doi.org/10.1016/j.rdf.2014.03.001>
- Ali, A. & Daly, K. 2010. Macroeconomic determinants of credit risk: recent evidence from a cross country study, *International Review of Financial Analysis* 19(3): 165-171. <https://doi.org/10.1016/j.irfa.2010.03.001>
- Ashraf, M., Masood, O., Tvaronaviciene, M., Bora Aktan, B., Garškaitė-Milvydienė, K., Lace, N. 2019. Factors Affecting Development Patterns: Econometric investigation of Japan equity market, *Economic Research-Ekonomska Istraživanja* 32(1) <https://doi.org/10.1080/1331677X.2018.1551147>
- Athanasoglou, P., Brissimis, S. & Delis, M. 2009. Bank specific, Industry specific and macroeconomic determinants of bank profitability, *Journal of International Financial Markets, Institutions and Money* 18(2): 121–136. <https://doi.org/10.1016/j.intfin.2006.07.001>
- Aysan, A., Ozturk H., Polat A & Saltoğlu, B. 2016. Macroeconomic Drivers of Loan Quality in Turkey, *Emerging Markets Finance and Trade* 52(1): 98-109. <https://www.tandfonline.com/doi/abs/10.1080/1540496X.2016.1105688>
- Arellano, M. & Bond, S. 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *The Review of Economic Studies* 58(2): 277-297, R etrieved from <https://academic.oup.com/restud/article-abstract/58/2/277/1563354>
- Arellano, M. & Bover, O. 1995. Another Look at the Instrumental Variable Estimation of Error-Components Models, *Journal of Econometrics* 68(1): 29-51. [https://doi.org/10.1016/0304-4076\(94\)01642-D](https://doi.org/10.1016/0304-4076(94)01642-D)
- Beck, T., Demirgüç-Kunt, A., & Levine, R. 2006. Bank concentration, competition, and crises: First results, *Journal of Banking and Finance* 30(5): 1581–1603. <https://doi.org/10.1016/j.jbankfin.2005.05.010>
- Berger, A. & DeYoung, R. 1997. Problem Loans and Cost Efficiency in Commercial Banks, *Journal of Banking and Finance* 21(7): 849-870, Retrieved from <https://www.sciencedirect.com/science/article/pii/S0378426697000034>
- Blundell, R. & Bond, S. 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics* 87(1): 115-143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)
- Bock, Reinout & Demyanets, A. 2012. Bank Asset Quality in Emerging Markets: Determinants and Spillovers, *IMF Working Paper* 12/71, Retrieved from <https://www.imf.org/~media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/wp/2012/wp1271.ashx>
- Bofondi, M. & Ropele, T. 2011. Macroeconomic Determinants of Bad Loans: Evidence from Italian Banks, Bank of Italy Questioni di Economia e Finanza (Occasional Papers) No 89, Retrieved from <https://www.bancaditalia.it/pubblicazioni/qef/2011-0089/index.html?com.dotmarketing.htmlpage.language=1>
- Boudriga, A., Taktak, N. & Jellouli, S. 2009. Banking supervision and nonperforming loans: a cross country analysis, *Journal of Financial Economic Policy* 1(4): 286-318, Retrieved from <https://econpapers.repec.org/RePEc:eme:jfeppp:v:1:y:2009:i:4:p:286-318>
- Chaibi, H. & Ftiti, Z. 2015. Credit risk determinants: Evidence from a cross-country study, *Research in International Business and Finance* 33(C): 1-16. <https://doi.org/10.1016/j.ribaf.2014.06.001>

- Dash, M. & Kabra, G. 2010. The determinants of non-performing assets in Indian commercial bank: An Econometric study, *Middle Eastern Finance and Economics* 7: 94-106, Retrieved from [https://www.researchgate.net/publication/258090738\\_The\\_Determinants\\_of\\_Non-Performing\\_Assets\\_in\\_Indian\\_Commercial\\_Bank\\_An\\_Econometric\\_Study](https://www.researchgate.net/publication/258090738_The_Determinants_of_Non-Performing_Assets_in_Indian_Commercial_Bank_An_Econometric_Study)
- Demirgüç-Kunt, A. & Huizinga, H. 1999. Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence, *The World Bank Economic Review* 13(2): 379-408. <https://doi.org/10.1093/wber/13.2.379>
- Demirgüç-Kunt, A. & Detragiache, E. 2002. Does deposit insurance increase banking system stability? An empirical investigation, *Journal of Monetary Economics* 49(7): 1373-1406. [https://doi.org/10.1016/S0304-3932\(02\)00171-X](https://doi.org/10.1016/S0304-3932(02)00171-X)
- Dietrich, A. & Wanzenried, G. 2011. Determinants of bank profitability before and during the crisis: Evidence from Switzerland, *Journal of International Financial Markets, Institutions and Money* 21(3): 307-327. <https://doi.org/10.1016/j.intfin.2010.11.002>
- Dhar, S. & Bakshi, A. 2015. Determinants of loan losses of Indian Banks: A panel study, *Journal of Asia Business Studies* 9(1): 17-32, Retrieved from <https://www.emeraldinsight.com/doi/10.1108/JABS-04-2012-0017>
- Ezeoha, A. 2011. Banking consolidation, credit crisis and asset quality in a fragile banking system: Some evidence from Nigerian data, *Journal of Financial Regulation and Compliance* 19(1): 33-44, Retrieved from <https://www.emeraldinsight.com/doi/10.1108/13581981111106158>
- Espinoza, R. & Prasad, A. 2010. Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects, *IMF Working Paper*, Middle East and Central Asia Department (WP/10/224), Retrieved from <https://www.imf.org/external/pubs/ft/wp/2010/wp10224.pdf>
- Fakhry, B., Aktan, B., Masood, O.; Tvaronavičienė, M., Celik, S. 2018. The Impact of a recent natural disaster on the Japanese financial markets: empirical evidence, *Journal of Competitiveness* 10(2): 56-71 <https://doi.org/10.7441/joc.2018.02.04>
- Fofack, H. 2005. Non-performing loans in sub-Saharan Africa: Causal Analysis and Macroeconomic Implications, World Bank Policy Research Working Paper Nos. 3769, Retrieved from <http://documents.worldbank.org/curated/en/446961468104639856/Nonperforming-loans-in-Sub-Saharan-Africa-causal-analysis-and-macroeconomic-implications>
- Gerlach, S., Peng W. & Shu, C. 2005. Macroeconomic conditions and banking performance in Hong Kong SAR: A panel data study, Bank for International Settlements, Basel. BIS papers No. 22, Retrieved from <https://www.bis.org/publ/bppdf/bispap22x.pdf>
- Godlewski, C. 2005. Capital Regulation and Credit Risk Taking: Empirical Evidence from Banks in Emerging Market Economies, *Journal of Banking Regulation* 6(2): 128-145, Retrieved from [https://www.researchgate.net/publication/23743752\\_Capital\\_Regulation\\_and\\_Credit\\_Risk\\_Taking\\_Empirical\\_Evidence\\_from\\_Banks\\_in\\_Emerging\\_Market\\_Economies](https://www.researchgate.net/publication/23743752_Capital_Regulation_and_Credit_Risk_Taking_Empirical_Evidence_from_Banks_in_Emerging_Market_Economies)
- IMF, Annual report 2005. Retrieved from <http://www.imf.org/en/Publications/AREB/Issues/2016/12/31/Annual-Report-of-the-Executive-Board-for-the-Financial-Year-Ended-April-30-2005>
- İslamoğlu, M. 2015. The Effect of Macroeconomic Variables on Non-performing Loan Ratio of Publicly Traded Banks in Turkey, *WSEAS Transactions on Business and Economics* 12: 12-20, Retrieved from <http://www.wseas.org/multimedia/journals/economics/2015/a045707-290.pdf>
- Jiménez, G., Salas, V. & Saurina, J. 2006. Determinants of collateral, *Journal of Financial Economics* 81(2): 255-281, Retrieved from <https://www.sciencedirect.com/science/article/pii/S0304405X05002369>
- Klein, N. 2013. Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance, IMF Working Paper, European Department, (P/13/72), Retrieved from <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Non-Performing-Loans-in-CESEE-Determinants-and-Impact-on-Macroeconomic-Performance-40413>
- Louzis, D., Vouldis, A. & Metaxas, V. 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios, *Journal of Banking and Finance* 36(4): 1012-1027. <https://doi.org/10.1016/j.jbankfin.2011.10.012>

- Macit, F. 2012. What Determines the Nonperforming Loans Ratio: Evidence from Turkish Commercial Banks, *CEA Journal of Economics* 7(1): 33-41, Retrieved from <https://journal.cea.org.mk/index.php/cejournal/article/view/108>
- Mahmudi, S. 2013. Correlation between Growth Rate and Non Performing Retail Loans in the Republic of Macedonia, *International Journal of Academic Research in Accounting, Finance and Management Sciences* 3(3): 133-138, Retrieved from [http://hrmars.com/hrmars\\_papers/Article\\_16\\_Correlation\\_between\\_Growth\\_Rate.pdf](http://hrmars.com/hrmars_papers/Article_16_Correlation_between_Growth_Rate.pdf)
- Makri, V., Tsagkanos, A. & Bellas, A. 2014. Determinants of Nonperforming Loans: The Case of Eurozone, *Panoeconomicus* 61(2): 193-206, Retrieved from <https://panoeconomicus.org/index.php/jorunal/article/view/72>
- Masood, O.; Tvaronavičienė, M.; Javaria, K. 2019. Impact of oil prices on stock return: evidence from G7 countries, *Insights into Regional Development* 1(2): 129-137. [https://doi.org/10.9770/ird.2019.1.2\(4\)](https://doi.org/10.9770/ird.2019.1.2(4))
- Messai, A. & Jouini, F. 2013. Micro and Macro Determinants of Non-Performing Loans, *International Journal of Economics and Financial Issues* 3(4): 852-860, Retrieved from <http://www.econjournals.com/index.php/ijefi/article/view/517>
- Pesaran, M., Shin, Y. & Smith, R. 2001. Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics* 16(3): 289-326, Retrieved from <https://onlinelibrary.wiley.com/doi/pdf/10.1002/jae.616>
- Quagliariello M. 2007. Bank's riskiness over the business cycle: A panel analysis on Italian intermediaries, *Applied Financial Economics*, 17(2): 119-138, Retrieved from <https://www.tandfonline.com/doi/full/10.1080/09603100500486501>
- Rossi, S., Schwaiger M. & Winkler, G. 2008. Linking Managerial Behaviour to Cost and Profit Efficiency in the Banking Sectors of Central and Eastern European Countries, *Kredit und Capital* 41(4): 598-629, Retrieved from <https://ideas.repec.org/a/kuk/journl/v41y2008i4p589-629.html>
- Salas, V. & Saurina, J. 2002. Credit risk in two institutional regimes: Spanish commercial and savings banks, *Journal of Financial Services Research* 22(3): 203–224, Retrieved from <https://link.springer.com/article/10.1023/A:1019781109676>
- Swamy, V. 2012. Impact of Macroeconomic and Endogenous Factors on Nonperforming Bank Assets, *International Journal of Banking and Finance* 9(1): 27-47, Retrieved from <https://mpira.ub.uni-muenchen.de/49600/1/Non-performing%20bank%20assets.pdf>
- Tesfaye, T. 2012. Determinants of Banks Liquidity and Their Impact on Financial Performance: Empirical Study on Commercial banks in Ethiopia, Published thesis (MSc). Addis Ababa University, Ethiopia, Retrieved from <http://etd.aau.edu.et/handle/123456789/14989?show=full>
- Vatansever, M. & Hepşen, A. 2013. Determining Impacts on Non-performing loan ratio in Turkey, *Journal of Finance and Investment Analysis* 2(4): 119-129, Retrieved from [http://www.sciencpress.com/Upload/JFIA%2FVol%202\\_4\\_7.pdf](http://www.sciencpress.com/Upload/JFIA%2FVol%202_4_7.pdf)
- Williams, J. 2004. Determining management behavior in European banking, *Journal of Banking and Finance* 28(10): 2427–2460. <https://doi.org/10.1016/j.jbankfin.2003.09.010>
- Zribi, N. & Boujelbène, Y. 2011. The factors influencing bank credit risk: The case of Tunisia, *Journal of Accounting and Taxation* 3(4): 70-78, Retrieved from <http://academicjournals.org/journal/JAT/article-full-text-pdf/C53D91B795>

## Appendix

### List of Banks:

Country	Bank Name	Country	Bank Name
Bahrain	Ahli United bank	Oman	Bank Muscat
Bahrain	Arab Banking Corporation	Oman	Ahli Bank OM
Bahrain	Al Baraka Banking Group	Oman	Bank Dhofar
Bahrain	Gulf International Bank	Oman	National Bank of Oman
Bahrain	BBK	Oman	Oman Arab Bank

Bahrain	National Bank of Bahrain	Oman	HSBC Bank Oman
Bahrain	Al Salam Bank	UAE	National Bank of Abu Dhabi
Bahrain	Kuwait Finance House	UAE	Emirates NBD
Bahrain	United Gulf Bank	UAE	First Gulf Bank
Bahrain	Bahrain Islamic Bank	UAE	Abu Dhabi Commercial Bank
Bahrain	Khaleeji Commercial Bank	UAE	Dubai Islamic Bank
Bahrain	Future Bank	UAE	Abu Dhabi Islamic Bank
Bahrain	Alubaf Arab International Bank	UAE	Mashreq Bank
Bahrain	BMI Bank	UAE	Union National Bank
Bahrain	Bahrain Development Bank	UAE	Commercial Bank of Dubai
Saudi Arabia	National Commercial Bank	UAE	Al Hilal Bank
Saudi Arabia	Al Rajhi Bank	UAE	National Bank of Ras Al Khaimah
Saudi Arabia	Samba Financial Group	UAE	Sharjah Islamic Bank
Saudi Arabia	Riyadh Bank	UAE	United Arab Bank
Saudi Arabia	Saudi British Bank	UAE	Bank of Sharjah
Saudi Arabia	Banque Saudi Fransi	UAE	National Bank of Fujairah*
Saudi Arabia	Arab National Bank	UAE	Commercial Bank International
Saudi Arabia	Saudi Hollandi Bank	UAE	National Bank of Um Al Qaiwain*
Saudi Arabia	Alinma Bank	UAE	Ajman Bank*
Saudi Arabia	Bank Al Jazira	UAE	Emirates Islamic Bank
Saudi Arabia	Bank Al Bilad	UAE	Noor Bank*
Kuwait	National Bank of Kuwait	Qatar	Qatar National Bank
Kuwait	Kuwait Finance House KU	Qatar	Qatar Islamic Bank
Kuwait	Burgan Bank	Qatar	The Commercial Bank QSC
Kuwait	Gulf Bank KSC	Qatar	Doha Bank
Kuwait	Al Ahli Bank of Kuwait KSC	Qatar	Masraf Al Rayan
Kuwait	Commercial Bank of Kuwait	Qatar	Al Khalijee Commercial Bank
Kuwait	Ahli United Bank KSC	Qatar	Barwa Bank
Kuwait	Boubyan Bank	Qatar	Qatar International Islamic Bank
Kuwait	Kuwait International Bank*	Qatar	Ahli Bank QSC
Kuwait	Warba Bank*	Qatar	Qatar Development Bank*
Kuwait	Industrial Bank of Kuwait	Qatar	International Bank of Qatar
Oman	Oman Development Bank*		

\*denotes extracted banks for empirical analysis. All banks were used for

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## SUSTAINABLE ENERGY SYSTEMS IN THE DIGITAL ECONOMY: CONCEPT OF SMART MACHINES\*

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**Abstract.** The concept of the creation of universal smart machines for power systems and critical infrastructure is discussed herein in terms of digital economy requirements. The functional requirements for a universal smart machine for sustainable energy systems are systematized based on a comparative analysis of technology. The requirements determine the approaches to the implementation of software, hardware and design solutions that provide diagnostics and monitoring of the energy state of infrastructures, systems for individual and collective power supply, life support systems of buildings, the state of household appliances, IoT devices, and devices of the housing and utilities sector. The recommendations on the constructive implementation of smart machines are given, making it possible to improve the existing approaches to quality assessment of the services provided in the energy industry. The concept of universal smart machines opens up the opportunities to increase the efficiency of providing the industry and households with a new type of information management services in the field of control over energy infrastructure as one of the main components of the digital economy.

**Keywords:** smart networks; Internet of things; digital economy; smart machine; monitoring; intelligent control.

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[http://doi.org/10.9770/jesi.2019.6.4\(30\)](http://doi.org/10.9770/jesi.2019.6.4(30))

**JEL Classifications:** L94, Q40, O30

### 1. Introduction

The process of urbanization is increasing steadily, resulting in the intellectualization of the infrastructure (Akberdina *et al.*, 2017; Petrenko *et al.*, 2019). Creation of the technological basis for the development of the

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innovative infrastructure providing the diagnostics and monitoring of life support systems, the state of household appliances, and housing and communal service devices is becoming a highly relevant problem (Khelifi *et al.*, 2018). This process is steadily associated with the development of technological solutions in the field of energy monitoring, predictive maintenance of industrial and social infrastructure (Kireev *et al.*, 2018b; Berdyugina *et al.*, 2018; Vlasov *et al.*, 2017; Grigoriev *et al.*, 2018).

One of the directions is the transition of electric power supply systems to the IoT concept (Berdyugina *et al.*, 2018; Vlasov *et al.*, 2017; TAdviser, 2018; Rentiuk, 2017; Roslyakov *et al.*, 2015), which is a necessity in terms of rapid development of the digital economy. According to TAdviser, as of 2018, the number of connected Internet of Things devices in the world was about 2.1 billion, and it will exceed 5.0 billion by 2021/2022. Figure 1 shows the graphic representation of the number of connected IoT devices (TAdviser, 2018).

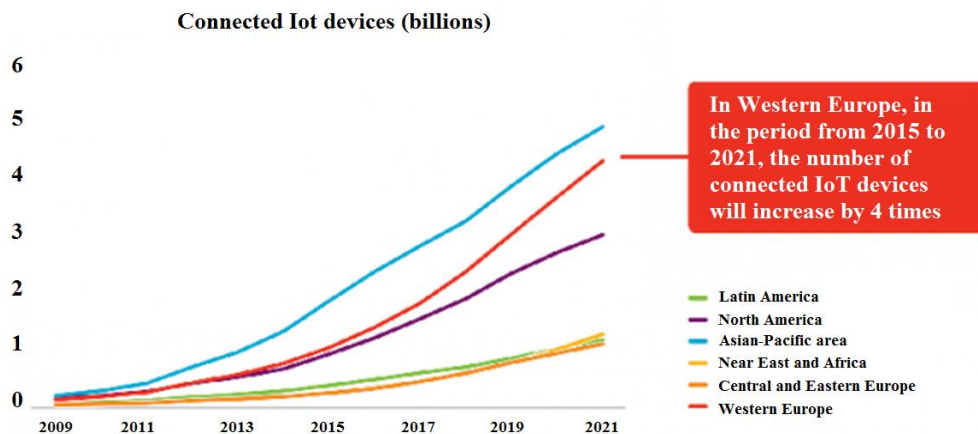


Fig. 1. Dynamics of the number of connected IoT devices

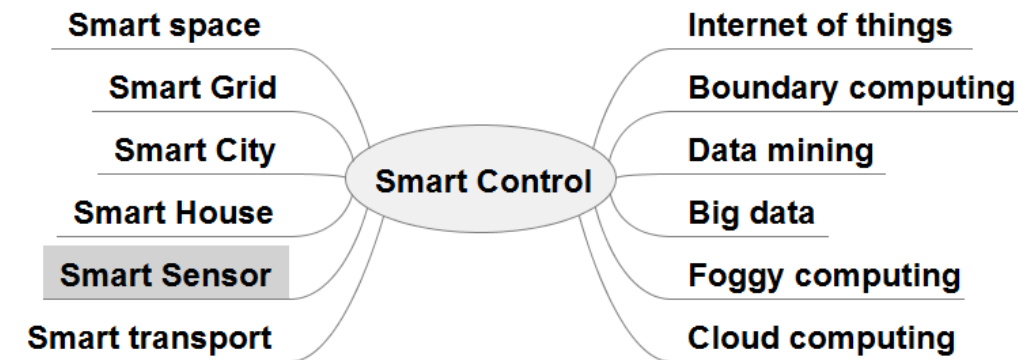
Source: (TAdviser, 2018)

According to the graph, the components of intelligent infrastructure are becoming more common. Their implementation is primarily aimed at the improvement of the efficiency of production and social infrastructure. At the same time, the energy sector is dominant in solving the problems of the development of the digital economy. The most large-scale projects in this segment have been developed and implemented in the USA, Canada, the European Union countries, China, South Korea, and Japan. In particular, by 2020, China expects to reach the level of 90-95% in the equipment with modern energy accounting systems which is 50-60% in the USA. The energy policy of these countries implies full equipment with energy monitoring smart devices (TAdviser, 2018).

The analysis of the modern trends of the digital economy sets the problem of creating new autonomous smart devices using the blockchain technology (Swan, 2015), “cloud” and boundary computing (Lyapin, & Finogeev, 2016; Barman, & Ahmed, 2015; Edelev *et al.*, 2018), which provide for remote diagnostics and monitoring of the energy status of the infrastructure facilities (Navigant Research, 2014; Kireev *et al.*, 2018a). This determines the problem associated with digital data processing in various formats, different volumes, taking into account the frequency of their receipt. To solve this problem, various implementations of universal smart machines are becoming more and more common elements of modern intelligent data processing systems in the digital economy (Navigant Research, 2014; Eneca, 2018).

## 2. Literature review

The problem of creation of a technological basis for the development of intelligent infrastructure in a digital economy can be solved only at the interface of such digital technologies as Smart Space, Smart Grid, Smart City, Smart House, Smart Sensor, Smart Transport, Internet of Things and Industrial Internet, Big Data, Intelligent Data Analysis (Figure 2) (Tupchienko, 2018; Lee *et al.*, 2017). The technological basis itself is included in the concept of Smart Control, which provides registration, accounting and intelligent processing of data from digital smart devices.



**Fig. 2.** The relationship of technology to create a technological basis for the development of intellectual-digital data collection infrastructure

Currently, the energy sector is undergoing a period of global change. The Smart Grid concept is the main trend affecting the development of information systems in the energy sector (TAdviser, 2018). The Smart Grid technological solutions can be divided into several key areas: (1) measuring devices and facilities, including, primarily, smart meters and smart sensors (Vasiliev, & Chernov, 2012; Andreev *et al.*, 2016); (2) improved management practices (Tupchienko, 2018); (3) advanced technologies and components of the electrical network (Navigant Research, 2014); (4) integrated interfaces and decision support methods, energy demand management technologies, distributed monitoring and control systems; (5) integrated communications (Lee *et al.*, 2017).

Therefore, one of the problems of introducing the components of the digital economy is the universalization, unification, and standardization of terminal devices – suppliers of the monitored information.

## 3. Methods

In terms of the intellectualization of data collection systems for the digital economy, special attention is paid not only to devices and individual sensors but also to system-wide efficiency. With the increase in the volume of transmitted data and the use of IoT, new problems arise due to the fact that: computational capabilities with linear growth of centralized cloud computing cannot meet the needs of processing data from several data sources simultaneously; network bandwidth and data transfer speeds have become a weak point due to the increase in the number of users; most end users are usually mobile devices that do not have enough computing resources to store and process large amounts of information.

Energy companies also face the necessity to introduce new standards of operation and maintenance to continuously improve the balance between supply reliability and costs. An important parameter is the quality of electricity, which determines the compatibility and features of the equipment. The standard values of power

quality indicators (PQI) and their list are established by the standards (in the European Union – EN 50160, IEC 61000-4-30: 2008; in Russia – GOST R 54149, GOST 13109-97, etc.), which are the guideline for the developers (Zhornyak *et al.*, 2010; de Andrade *et al.*, 2019).

Another key problem in the energy sector is the protection of electrical equipment. Table 1 shows the results of a comparative analysis of electrical equipment protection technologies operating in the residential and industrial infrastructure. All this determines the set of methods used to ensure system-wide energy efficiency (Tupchienko, 2018; Zhornyak *et al.*, 2010).

**Table 1.** Indicators for assessment of the electrical equipment protection technologies

Protection	Housing infrastructure	Industrial infrastructure
Overload	Differential machines Surge suppressors Relays of voltage control Thermal relays Circuit breakers	Current protection (electromagnetic relays, semiconductor circuit breaker releases) Temperature protection (thermal releases, electrothermal relays)
Short-circuit (SC)	Differential machines Circuit breakers Fuses	Fuses Circuit breakers Current cut-off (electromagnetic primary relay indirect action)
Leakage	Residual current devices (RCDs) Differential machines	Differential current devices (DCDs)
Lightning	Lightning protection	Lightning protection
Reactive power compensation	Not used	Filter compensating devices (FCDs) and
Asymmetry and non-sinusoidality of current and voltage curves	Surge protectors	Filter balancing devices (FBDs)
Voltage dips (ACF)	Surge protectors Relays of voltage control	Devices for automatic power reserve switch-on (DAPRSOs)
Arc-over and combustion occurrence	Arc-over detection protection devices (ADPDs)	Arc-over detection protection devices (ADPDs)

According to the results of a comparative analysis of electrical equipment protection technologies operating in the housing and industrial infrastructure, the following conclusions can be drawn:

- protection technologies operating at power industry enterprises are more complex than in housing infrastructure;
- for housing infrastructure, the greatest coverage from various types of protection is provided by the differential machine, able to constitute the main component of the infrastructure based on smart machines and IoT principles.

As an example, let us consider in more detail the concept of implementing a universal smart machine (developed by LLC “Connect”, Russia) as a technological element for the development of the energy infrastructure in the digital economy.

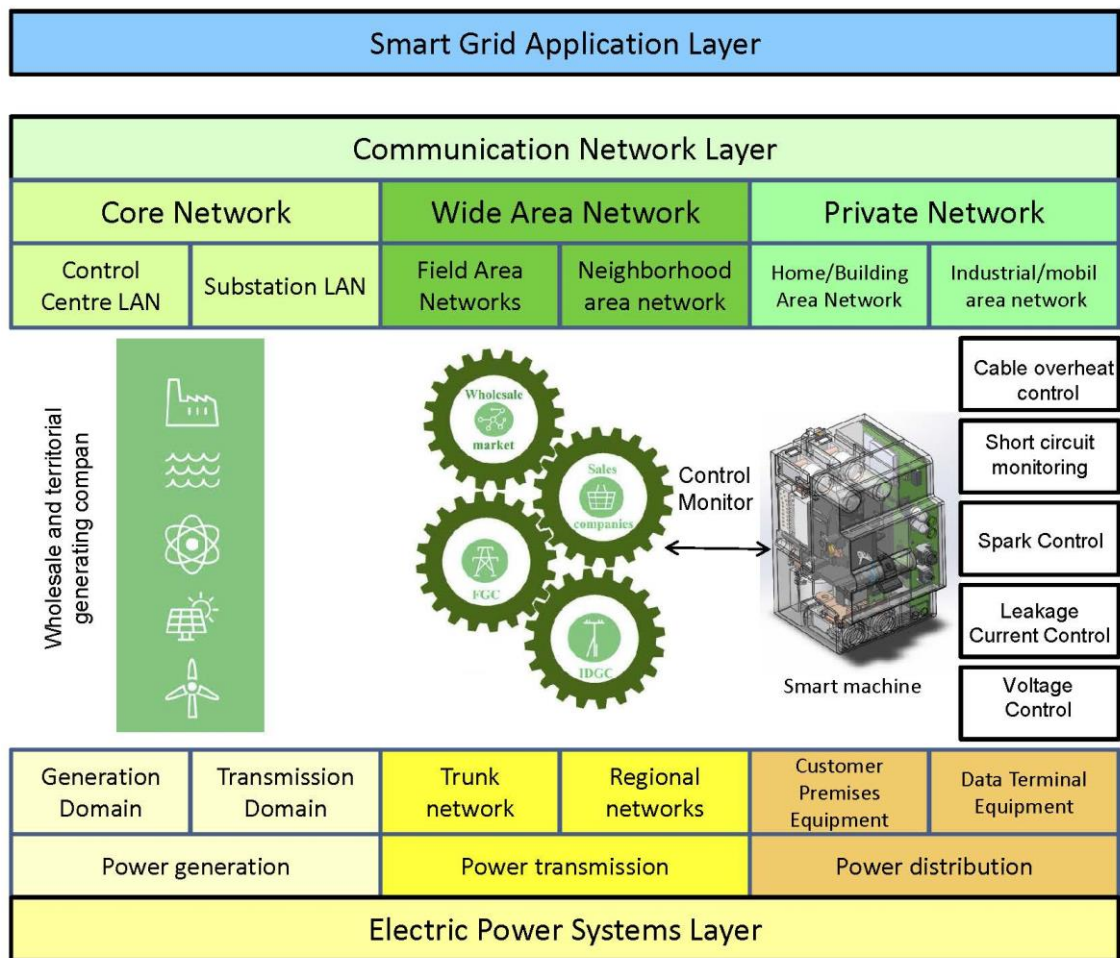
#### 4. Results

The analysis of the problems in the field of intellectualization of the energy sector infrastructure in the digital economy shows that the necessity of creation of simple, universal, intelligent smart machines, as the terminal elements of the global Smart Grid system, becomes obvious. A universal smart machine should constructively be

a device in a form-factor of a circuit breaker that implements certain triggering algorithms. Let us analyze the main characteristics of such devices and the requirements for them.

Intelligent data collection systems in the energy sector include the following units: (1) automated systems, such as an automated information and measurement system for electricity metering, a dispatch control system, a process control system; (2) results of control measurements, meter readings for non-automatic collection of information, instrument readings for measurement and control.

The concept of implementing an intelligent smart machine for the intellectualization of the infrastructure of the energy sector includes two main functional units: an integrated power protection unit and a unit for monitoring its parameters (Figure 3) (Zhornyak *et al.*, 2010; de Andrade *et al.*, 2019; Nafi *et al.*, 2016). Modern complex power supply protection should include: protection against cable overheating, protection against short circuits, protection against sparking, protection against significant voltage deviations, protection against current leakage. The monitoring function is focused on the ability to control parameters such as voltage, current, power, and power consumption. In addition, monitoring in intelligent protection systems should allow determining the state of the system and the cause of the shutdown.

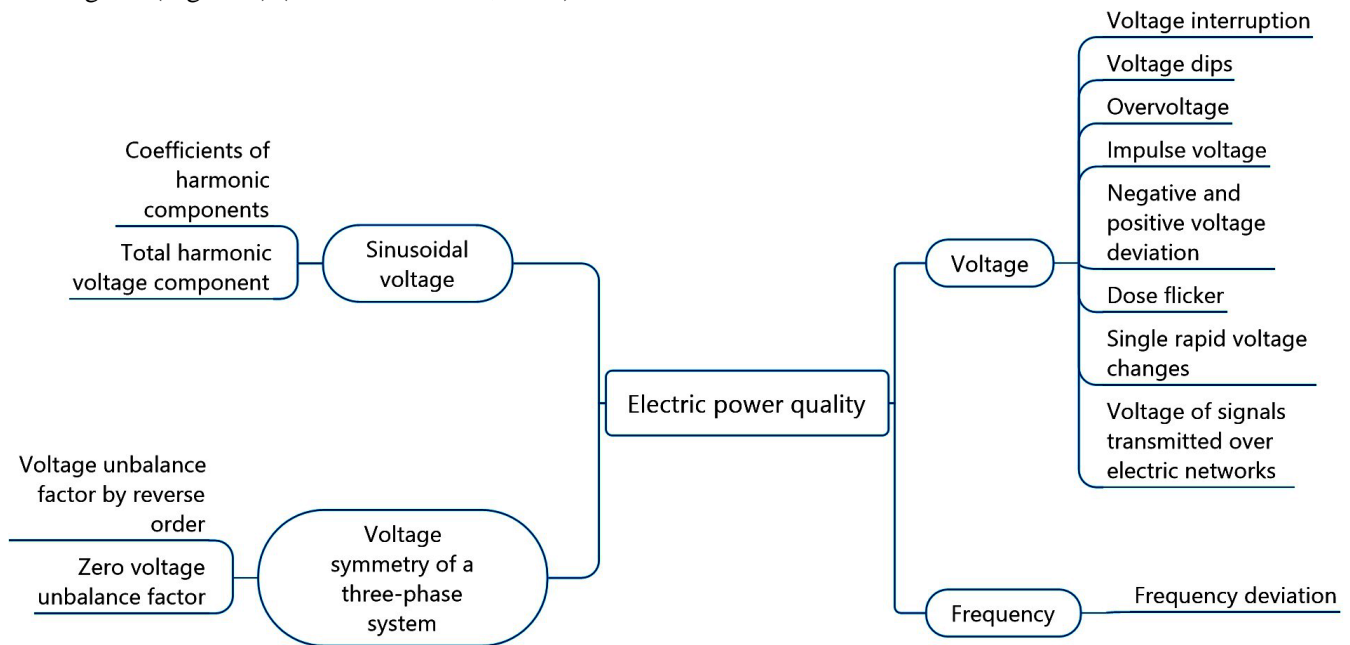


**Fig. 3.** Functional diagram of the integration of smart machines in the intelligent energy infrastructure (as illustrated by Russia)



Figure 3 shows the interaction of integrated power system components as illustrated by Russia, where the companies of various types are represented (Kuzmin *et al.*, 2019). The wholesale market provides the opportunity for large buyers of electricity and power to purchase it directly from generating companies. The grid companies manage the Unified National Electric Grid, provide services for electricity transmission within the trunk and interregional networks to producers. Individual sales companies interact with the end consumers, which provide accounting and management of operating modes. The main task of the work is to determine the role and analysis of specific options for the implementation of universal, intelligent smart machines that interact with specific consumers. The functions of the Control Monitor at the end-user level, implemented by the smart-machine, assume: State (on/off); Electricity consumption in kWh; Power supply voltage; Line current consumption; Cause of shutdown (overload/short circuit/leakage current/arcing).

One of the strategic objectives of the implementation of the Smart Grid is to reduce the losses at all levels of generation, transmission, and consumption of electricity and to ensure the set level of quality. At the same time, the quality of electrical energy and reliability of electric power systems are characterized by standardized indicators. The data on the electrical network is taken at the first stage of the power quality analysis algorithm. Further, two sets of tasks are carried out in parallel: quality control of the electrical network and power consumption control. In a formalized form, the list of properties of the electrical energy quality can be represented as a diagram (Figure 4) (de Andrade *et al.*, 2019).



**Fig. 4.** Power quality indicators taken into account in smart data collection systems

To create a basis for the development of infrastructure by the example of the energy industry in terms of digitalization, it is proposed to implement the integrated monitoring of the local parameters of the power grid performed on the basis of a multifunctional protection device made in the form of a single device (intelligent smart machine). This solution is qualitatively different from the existing systems in terms of size, cost, and complexity of installation. The integration of intellectual functions of control and monitoring into protection systems will ensure the fast introduction of modern digital technologies into the residential and industrial infrastructure. Smart machines are the basic element that implements such an integration.

A power quality control system includes the following components:



- measuring components (measuring voltage transformers – MVTs, measuring current transformers – MCTs);
- complex components, measuring and computing complexes (meters of power quality indicators – MPQIs, software and hardware complexes of electricity quality control – PTCs);
- connecting components (communication lines between instrument transformers and PQI meters, GSM modems, equipment and Ethernet networks, concentration units – HUBs);
- computational components (data servers, data collection stations and workstations with installed system and application software).

The requirements systematized in Table 2 are the basis for the design of universal smart machines as data collection devices. They define the approaches to the implementation of the software, hardware and design solutions that provide diagnostics and monitoring of the energy state of infrastructures, individual and collective energy systems, life support of buildings, the state of household appliances, IoT devices, and housing and communal services (Eneca, 2018).

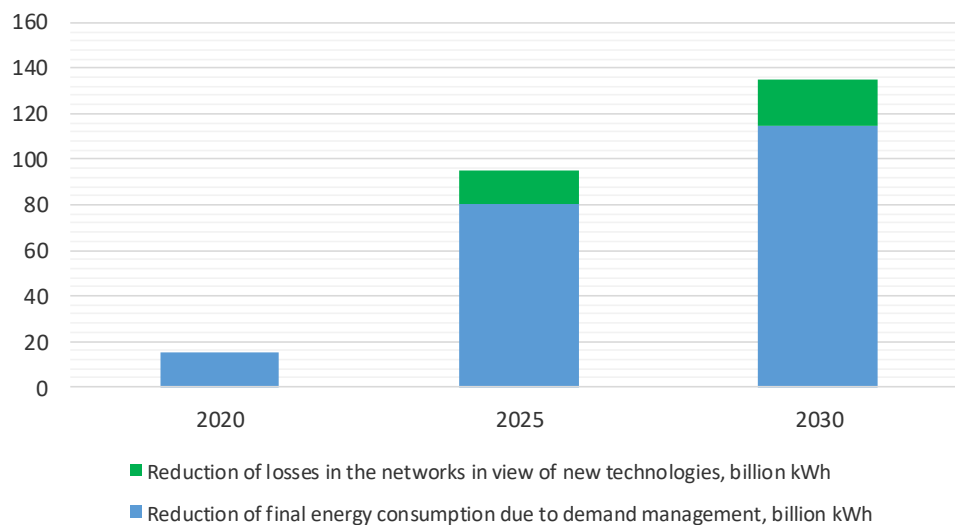
**Table 2.** Functional characteristics of the smart machine, monitoring and control system, information system

Component of the technology subbase	Functions of the component
Smart machine	Continuous reading of the main indicators taken from the electrical network (analysis of the mains voltage, parameters of the flowing current, power consumption)
	Continuous analysis of the main indicators taken from the electrical network (analysis of the mains voltage, parameters of the flowing current, power consumption)
	Continuous quality control of the main indicators taken from the electrical network (analysis of the mains voltage, parameters of the flowing current, power consumption) to identify the scenario of exceeding the allowable thresholds for automatic shutdown
	Continuous monitoring of the frequency of the alternating current on the amplitude-time characteristics of the electrical signal to identify the scenario of a spark in the conductor for automatic shutdown
	Network protection based on the principles of the differential machine, AFDD and the Internet of things
	Implementation of automatic shutdown technology
	Implementation of forced disconnection technology according to the message received from the monitoring and control system
	Urgent notification of the monitoring and control system
	Continuous provision of data on the operation of monitored devices to the monitoring and control system
	Continuous reception of messages for forced disconnection from the monitoring and control system
	Receipt of the executive decisions on normalization from the monitoring and control system
	Analysis of current and voltage to identify the forced shutdown scenarios for the smart machine in case of exceeding the threshold values
Monitoring and control system	Leakage current analysis to identify the forced shutdown scenario for the smart machine in case of exceeding the threshold values
	Analysis of the alternating current frequency by the amplitude-time characteristics of the electrical signal to identify the scenario of the appearance of a spark in the conductor and forced shutdown of the smart machine
	Analysis of the loading of the three-phase power supply phases to identify a skew scenario with the possibility of forming a normalization decision
	Transfer of the shutdown message to the smart machine
	Transfer of executive normalization solutions to the smart machine
	Reporting on the significance of the main indicators at the facilities (elements) of the residential and small industrial infrastructure
	Reporting on the emergency situations at the facilities (elements) of the residential and small industrial infrastructure
	Receipt of the messages from the information system
	Notification of the information system about the emergency situation with the objects (elements) of the housing and small industrial infrastructure
	Information system data transfer from the objects (elements) of the residential and small industrial infrastructure

Component of the technology subbase	Functions of the component
Information system	Receipt of data from the monitoring and control system about the value of the main parameters of current, voltage and power consumption from objects (elements) of residential and small industrial infrastructure
	Receipt of the notifications from the monitoring and control system about the emergency situation with the objects (elements) of the housing and small industrial infrastructure
	Storage of the data on the values of the basic parameters of current, voltage and power consumption from the objects (elements) of housing and small industrial infrastructure
	Analysis, including predictive one, of the obtained data on the value of the main parameters of current, voltage and power consumption from the facilities (elements) of the residential and small industrial infrastructure
	Analysis of the functioning of the algorithms implemented by the smart machine and the monitoring and control system
	Reporting
	Alert on abnormal situation objects (elements) of housing and small industrial infrastructure

## 5. Discussion

The result of the research is the concept of implementation of an intelligent smart machine in the energy sector. The proposed concept of a smart machine differs from the well-known analogs in that it is a comprehensive solution to ensure the protection of power grids with built-in intellectual functions, including the functions of monitoring parameters. This solution makes it possible to perform the transition to a digital economy in the residential and industrial power industry quickly and at minimum expense, since no individual installation of intelligent control and monitoring elements is required, while the installation and replacement of the security systems are carried out regularly with a certain frequency. In the long term, the monitoring function will make it possible both to reduce final energy consumption, by controlling the demand, and to improve the quality of electricity with reduced losses, by simplifying the search for the causes of deterioration. Figure 5 gives a predictive estimate of the possible effect of the introduction of Smart Grid systems based on smart machines, according to pilot Smart Grid projects, which have been launched in various countries (Navigant Research, 2014; Eneca, 2018; TAdviser, 2018; Nafi *et al.*, 2016). It should be noted that for many reasons, there is extremely high uncertainty of the expected effects of the introduction (Navigant Research, 2014; Eneca, 2018; TAdviser, 2018).



**Fig. 5.** Predictive assessment of energy consumption reduction due to the implementation of Smart Grid systems based on smart machines

Thus, the results of the creation of a smart meter (a special case of a smart machine), or the technological basis for the development of innovative housing infrastructure is a comprehensive solution and is based on basic digital technologies (Figure 1). For normal operation, a smart meter must have an interface for interaction with an automated information-measuring system for commercial metering of electricity. Such a system in general is a combination of hardware and software that provides for the remote collection, storage, and processing of data on energy flows in power grids. It is necessary for the automation of power management and also performs the technical functions of monitoring the operating modes of electrical equipment.

Comparative evaluation of interfaces and protocols for the implementation of the interaction of a smart meter (intelligent smart machine in general) with monitoring and control devices showed that:

- there is a wide variety of technologies, protocols, and standards for communicating IoT devices even within the same industry (utilities/smart meters, transportation, industry, etc.) and none of the existing protocols is the only candidate for the universal protocol for all devices accounting;
- in each industry, there are specific requirements corresponding to the tasks and needs to be solved, in this regard, the development of common universal technological communication standards for the market of the Internet of Things in general is hardly feasible and possible; however, on the other hand, a set of key technologies, protocols, and standards is required for each vertical market and, possibly, its separate segments;
- it is necessary to shrink from closed protocols and interfaces to standards-based solutions;
- if there is a task of monitoring and metering of electricity in the wholesale and retail markets (for example, monitoring of transformer substations), then special attention should be paid to solutions based on standardized protocols. These protocols are well suited for this task. Such a protocol can be used when transferring data from electricity meters/DATDs to the upper level (SCADA system, AMRCS);
- the analysis of the protocols for compatibility showed that the Modbus family of protocols can be used in the residential sector. It is widely used in industry, it is universal and in demand in utilities. Today, the equipment from almost all manufacturers supports Modbus protocols;
- the PLC protocol is preferable when collecting data on the consumed electricity from the lower level (from electricity meters);
- the use of metering devices with MBUS is fully justified for the residential construction of the premium segment (“smart” buildings). At the same time, the accounting system on MBUS can be harmoniously integrated into the existing automation system based on the KNX bus, which will provide complete and transparent automation from top to bottom. It is possible to use MBUS for ordinary housing, but here the not too high prevalence of this protocol will act as a retarding factor, and as a result, it will be linked to the selected vendor once.

According to the research results, it can be stated that universal smart automata are the ultimate element of data collection in the digital economy. Using the example of the energy sector, it can be noted that the use of such smart machines in the residential and industrial infrastructure provides high-quality diagnostics and monitoring of individual and collective energy supply systems.

## **Conclusion**

The proposed concept of a universal smart machine provides diagnostics and monitoring of individual and collective power supply systems, building life support, the state of consumer devices, IoT devices, and devices of the housing and utilities sector. As part of the technological solution, this device implements comprehensive protection of the electrical network. In addition to the basic protection functions, the smart machine will make it easier to record data on electricity consumption, quality of power supply, reduce the number of emergency situations, by simplifying their diagnostics. The proposed conceptual solutions open up opportunities for

improving the efficiency of design technologies and creating energy-efficient objects, providing industry and households with new information services in the control over energy infrastructure.

## References

- Akberdina, V.V., Tretyakova, O.V., & Vlasov, A.I. (2017). A Methodological Approach to Forecasting Spatial Distribution of Workplaces in an Industrial Metropolis. *Problems and Perspectives in Management*, 15(4), 50-61. [https://doi.org/10.21511/ppm.15\(4\).2017.05](https://doi.org/10.21511/ppm.15(4).2017.05)
- Andreev, K.A., Shakhnov, V.A., & Vlasov, A.I. (2016). Silicon Pressure Transmitters with Overload Protection. *Automation and Remote Control*, 77(7), 1281-1285. <https://doi.org/10.1134/S0005117916070146>
- Barman, A., & Ahmed, H. (2015). *Big Data in Human Resource Management – Developing Research Context*. <https://doi.org/10.13140/RG.2.1.3113.6166>
- Berdugina, O.N., Krivoshein, A.I., & Vlasov, A.I. (2018). Technological Platform for Innovative Social Infrastructure Development on Basis of Smart Machines and Principles of Internet of Things. In *2018 Global Smart Industry Conference (GloSIC)* (pp. 1-7). <https://doi.org/10.1109/glosic.2018.8570062>
- de Andrade, L.C.M., Nanjundaswamy, T., Oleskovicz, M., Fernandes, R.A.S., & Rose, K. (2019). Advances in Classification and Compression of Power Quality Signals. *Journal of Control, Automation and Electrical Systems*, 30, 402. <https://doi.org/10.1007/s40313-019-00446-1>
- Edelev, A.V., Senderov, S.M., Beresneva, N.M., Sidorov, I.A., & Feoktistov, A.G. (2018). Distributed Computing Environment for Analyzing the Vulnerability of Critical Infrastructures in the Power Industry. *Control Systems, Communications and Security*, 3, 197-231. <https://doi.org/10.2991/iwci-18.2018.7>
- Eneca. (2018). *SmartGrid*. Retrieved November 29, 2018, from [https://www.eneca.by/ru\\_smartgrid0/](https://www.eneca.by/ru_smartgrid0/)
- Grigoriev, P.V., Krivoshein, A.I., Shakhnov, V.A., Filin, S.S., Migalin, V.S., & Vlasov, A.I. (2018). Smart Management of Technologies: Predictive Maintenance of Industrial Equipment Using Wireless Sensor Networks. *Entrepreneurship and Sustainability Issues*, 6(2), 489-502. [http://doi.org/10.9770/jesi.2018.6.2\(2\)](http://doi.org/10.9770/jesi.2018.6.2(2))
- Khelifi, F., Bradai, A., Benslimane, A., Rawat, P., & Atri, M. (2018). A Survey of Localization Systems in Internet of Things. *Mobile Networks and Applications*, 1-25. <https://doi.org/10.1007/s11036-018-1090-3>
- Kireev, V.S., Filippov, S.A., Guseva, A.I., Bochkaryov, P.V., Kuznetsov, I.A., & Migalin, V. (2018a). Cloud Computing in Housing and Utility Services Monitoring Systems. In *Proceedings – 2018 6th International Conference on Future Internet of Things and Cloud Workshops, W-FiCloud 2018* (pp. 90-94). IEEE. <https://doi.org/10.1109/W-FiCloud.2018.00020>
- Kireev, V.S., Filippov, S.A., Guseva, A.I., Bochkaryov, P.V., Kuznetsov, I.A., Migalin, V., & Filin, S.S. (2018b). Predictive Repair and Support of Engineering Systems Based on Distributed Data Processing Model within an IoT Concept. In *Proceedings – 2018 6th International Conference on Future Internet of Things and Cloud Workshops (FiCloudW)* (pp. 84-89). IEEE. <https://doi.org/10.1109/W-FiCloud.2018.00019>
- Kuzmin, E.A., Volkova, E.A., & Fomina, A.V. (2019). Research on the Concentration of Companies in the Electric Power Market of Russia. *International Journal of Energy Economics and Policy*, 9(1), 130-136. <https://doi.org/10.32479/ijeep.7169>
- Lee, C.K.M., Zhang, S.Z., & Ng, K.K.H. (2017). Development of an Industrial Internet of Things Suite for Smart Factory towards Re-Industrialization. *Advances in Manufacturing*, 5(4), 335-343. <https://doi.org/10.1007/s40436-017-0197-2>
- Lyapin, A.M., & Finogeev, A.G. (2016). Technologies BIGDATA and Cloud Computing for Monitoring Energy Facilities in the Field of Housing And Communal Services. *News of Volgograd State Technical University*, 3(182), 53-58.
- Nafi, N.S., Ahmed, K., Gregory, M.A., & Datta, M. (2016). A Survey of Smart Grid Architectures, Applications, Benefits and Standardization. *Journal of Network and Computer Applications*, 76, 23-36. <https://doi.org/10.1016/j.jnca.2016.10.003>

Navigant Research. (2014). *Executive Summary: Smart Cities Smart Technologies and Infrastructure for Energy, Water, Transportation, Buildings, and Government: Business Drivers, City and Supplier Profiles, Market Analysis, and Forecasts*. Navigant Consulting, Inc. Retrieved November 30, 2018, from <http://boletines.prisadigital.com/smartcities.pdf>

Petrenko, Y., Vechkinzova, E., & Antonov, V. (2019). Transition from the industrial clusters to the smart specialization of the regions in Kazakhstan. *Insights into Regional Development*, 1(2), 118-128. [https://doi.org/10.9770/ird.2019.1.2\(3\)](https://doi.org/10.9770/ird.2019.1.2(3))

Rentiuk, V.A. (2017). Brief Guide to the Internet of Things Wireless Technologies. Part 1. Networks, Gateways, Clouds and Protocols. *Control Engineering Russia*, 6(72), 61-65.

Roslyakov, A.V., Vanyashin, S.V., & Grebeshkov, A.Yu. (2015). *The Internet of Things* (pp. 107-109). Samara: PGUTI.

Swan, M. (2015). *Blockchain: Blueprint for a New Economy*. O'Reilly Media, Inc. (p. 132).

TAdviser. (2018, December 20). *Smart Grids*. Retrieved April 29, 2019, from [http://www.tadviser.ru/index.php/Статья:Smart\\_Grid\\_%28Умные\\_Сети%29](http://www.tadviser.ru/index.php/Статья:Smart_Grid_%28Умные_Сети%29)

Tupchienko, V.A. (Ed.). (2018). *Digital Platforms for Lifecycle Management of Complex Systems*. Moscow: Nauchnyi konsultant. (p. 440).

Vasiliev, V.A., & Chernov, P.S. (2012). Smart Sensors, Sensor Networks and Digital Interfaces. *Measuring Equipment*, 10, 3-6.

Vlasov, A.I., Yudin, A.V., Salmina, M.A., Shakhnov, V.A., & Usov, K.A. (2017). Design Methods of Teaching the Development of Internet of Things Components with Considering Predictive Maintenance on the Basis of Mechatronic Devices. *International Journal of Applied Engineering Research*, 12(20), 9390-9396.

Zhornyak, L.B., Erzh, T.A., Osinskaya, V.I., & Barannik, S.O. (2010). The Study of Modeling Methods to Improve the Quality of Electrical Energy in the Systems of Power Supply of Electricity Consumers. *Electrical Engineering & Electromechanics*, 2.

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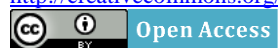
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## ANALYSIS OF RESPONDENTS' OPINIONS AND ATTITUDES TOWARD THE SECURITY OF PAYMENT SYSTEMS\*

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**Abstract.** The number of financial and cyber-attacks is increasing. The latter trend in financial and cyber security incidents is global and, as such it is being monitored globally. Cyber and financial statistical data and the growing number of certified information management systems show the practical importance of data security at the international level. The decisions to solve the data security problems are based on the technical point of view, protection motivation theory, and security standards. By analysing the security of payment system, this article aspires to aid in the development of secure systems. Its aim is to contribute to the knowledge and comprehension of the behaviour of payment systems users with special focus on the aspect of their security. The article analyses the opinions and attitudes of respondents toward the questions dealing with the security of payment systems and their behaviour when using payment cards. The analysis is carried out from the aspect of gender, age and education of respondents by using multidimensional statistical methods, namely factor analysis and analysis of dispersion.

**Keywords:** cyber-attack; security; payment systems; payment cards; security management; financial institution

**Reference** to this paper should be made as follows: Korauš, A.; Gombár, M.; Kelemen, P.; Polák, J. 2019. Analysis of respondents' opinions and attitudes toward the security of payment systems, *Entrepreneurship and Sustainability Issues* 6(4): 1987-2002. [http://doi.org/10.9770/jesi.2019.6.4\(31\)](http://doi.org/10.9770/jesi.2019.6.4(31))

**JEL Classifications:** F5, F52, K42, K24

**Additional disciplines** (besides the field of economics reflected in JEL classifications): information and communication; security, protection of people and property

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## **1. Introduction**

The question of effective economic security management has serious implications in the field of banking and other financial institutions in EU. It cannot be rationally resolved at the application level without forming a conceptual framework based on research and methodology. As a separate part of management supervision, the management of the economic security system should not prevent financial institutions from fulfilling their key functions and features. This can be possibly reached by integrating the process of ensuring the economic security into the mechanisms of general management of these institutions.

An average EU citizen believes that in “seeking to strengthen the European Union, the priority should be given primarily to the fight against crime”. According to many researchers, the majority of EU population is of the opinion that the most important public security problems are those of violent crimes, corruption, juvenile delinquency, and property crimes. It is their opinion that the police should pay utmost attention to the investigation of grave crimes, patrols in public places, and immediate response to received reports on crime. This indicates that the fight against crime has to get priority in ensuring public security (Eurostat database 2012).

Many leaders and decision makers in public and private organisations are realising that in addition to being a driver for innovation, productivity and growth, the digital environment also introduces uncertainties that can jeopardise economic and social prosperity. Digital security incidents can have far-reaching economic consequences for organisations, as for example in terms of disruption of operations, direct financial losses, and lawsuits, as well as in terms of loss of trust among their customers, employees, shareholders and partners. Although cases are still exceptional, while reflecting on the increasing reliance of industrial facilities, transportation systems and hospitals on ICT, one should also consider the possibility that digital security incidents can cause physical damage as well as human fatalities.

Finally, individuals are increasingly aware that there can be a downside to the many benefits they derive from the use of the digital environment. When their personal data are publicly disclosed or fall into the hands of unauthorised persons, these individuals face privacy breaches and potential physical, material and moral damage. They can be victims of financial fraud in relation to identity theft when their personal data or digital credentials are stolen from their own devices, compromised companies, or institutional information systems.

## **2. Theoretical background**

The emergence of big data and cloud computing services, growth in Internet speed and importance of wired and wireless data transfer, increasing possibilities of hardware and software, increase in human communication functions being taken over by smart phones, and other emerging functions suggest that the significance of information technologies in our lives is growing (Štitilis et al. 2016; Štitilis et al. 2017; Fuschi, Tvaronavičienė 2014; Tvaronavičienė et al. 2016; Tvaronavičienė 2018; Limba, Šidlauskas 2018; Skvarciany et al. 2018; Okoro, Ekwueme, 2018; Korauš, et al. 2019a; Korauš et al. 2019b; Šišulák 2017). In today's technically advanced world, autonomous systems are rapidly gaining in popularity. The security risk is preferably assessed by means of quantitative systematic risk assessment methods, such as RM/RA CRAMM (Mullerova 2016, Mamojka, Mullerova 2016; Hajdu et al., 2014; Kordik and Kurilovská 2018) in combination with crime forecast maps (Mullerova, Mamojka 2017). In many cases of shoulder-surfing attack, the attackers rely on their ability to observe and remember the details they have observed (Tari et al. 2006; Máté, Kiss, 2017; Roth and Richter 2006; Mura, Vlacseková 2018; Vlacseková, Mura 2017). Cybernetic security issues, which are often perceived as synonymous with the safety of critical infrastructure (Dobrovič et al., 2017).

The increase in the number of sophisticated incidents results from many factors (Jančíková, Pasztorová 2018; Jančíková, Veselovská 2018). One of them is that the migration of criminal activities online has professionalised the attacks and increased the overall level of threat to digital security. From the occasional isolated robber to well-organised transnational groups, criminals have been demonstrating considerable technical innovation skills to commit financial, information and identity theft and blackmail individuals, businesses and governments (Aven, 2012; Ashford, 2013; Feshner, 2014).

Other factors include terrorists and their supporters who in conjunction with physical attacks, have also extended their actions to the digital environment by multiplying attacks on Internet sites. Although few cases have been extensively documented, industrial digital espionage has been mentioned as being on the rise (Jackson, 2014).

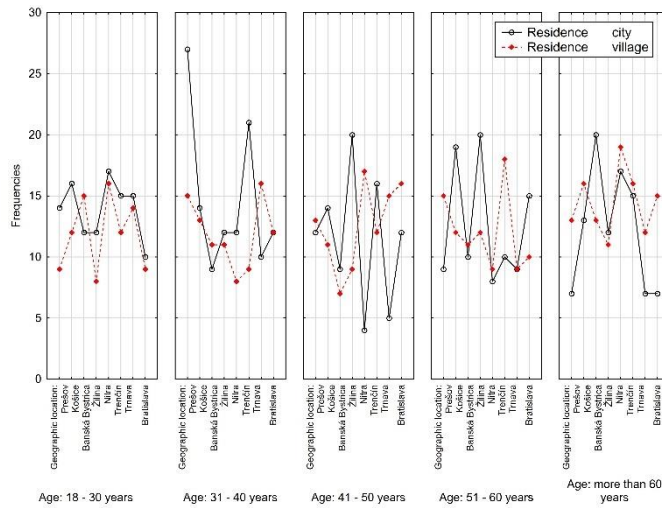
### **3. Material and methods**

The present article aims to contribute to the knowledge and comprehension of the behaviour of payment card users with special focus on the aspect of their security. The article analyses the opinions and attitudes of respondents toward the questions dealing with the security of payment systems and their behaviour when using payment cards. The analysis is carried out from the aspect of gender, age and education of respondents by using multidimensional statistical methods, namely factor analysis and analysis of dispersion. The research as well as the selection of representative sample were carried out as follows:

- Time horizon of the survey: 20.02.2018 – 20.07.2018
- Representative sample: 1,012 respondents
- Number of questionnaires issued: 4,700
- Number of (completed) questionnaires collected: 3,288

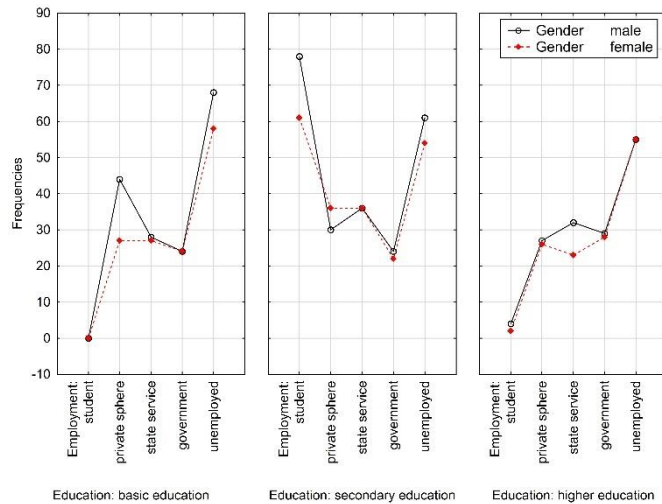
The representative sample containing 1,012 respondents was selected by random number generator from fully completed questionnaires (3,288) in such a way that it would represent the population of Slovakia over 18 years of age from the aspect of their education, size of municipality, and region they live in, and occupation.

The analysed set is represented in five age categories in ranges 18-30 years, 31-40 years, 41-50 years, 51-60 years and over 60 years. These categories are composed of 206, 212, 192, 196 and 213 respondents, respectively, which represents 2.22%, 20.80%, 18.84%, 19.23%, and 20.90% of the analysed set, respectively. The research was conducted on 540 men (52.99%) and 479 women (47.01%). Geographically, the respondents were from the regions of Prešov, Košice, Banská Bystrica Žilina, Nitra, Trenčín, Trnava and Bratislava in amounts 134 (13.15%), 140 (13.74%), 117 (11.48%), 127 (12.46%), 127 (12.46%), 144 (14.13%), 112 (10.99%) and 118 (11.58%), respectively. The statistical set was composed of respondents with primary (n=300; 29.44%), secondary (n=438; 42.98%) and university education (n=281; 27.58%). The analysed sample is composed of respondents living in towns (n=518; 50.83%) and villages (n=501; 49.17%). The structure of respondents can be seen in Figures 1 – 4.



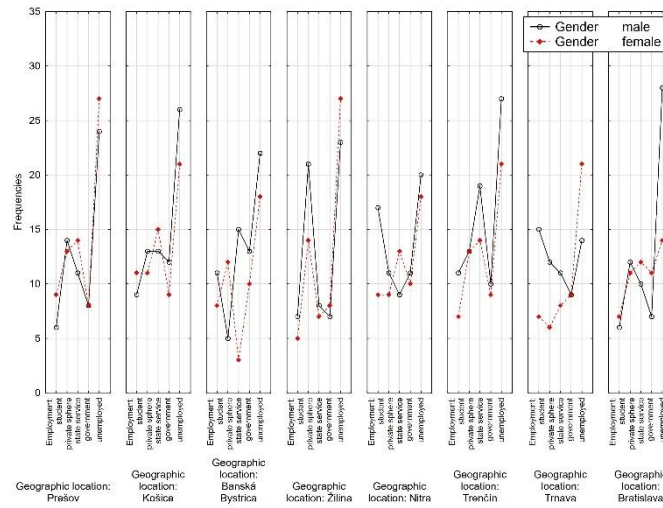
**Figure 1.** Structure of representative sample per residence, age and geographic region

*Source: Own study*



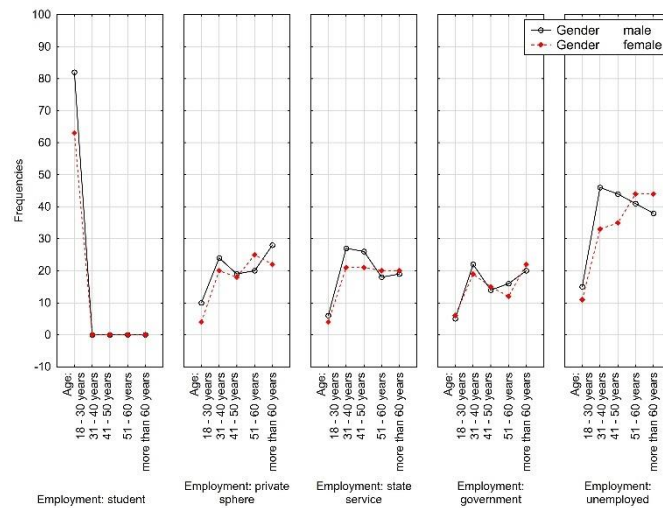
**Figure 2.** Structure of representative sample per education, gender and employment

*Source: Own study*



**Figure 3.** Structure of representative sample per geographic region, gender and employment

Source: Own study



**Figure 4.** Structure of representative sample per employment, gender and age

Source: Own study

## 4. Results

The analysis of the behaviour of respondents when making a payment and their opinions on their security was based on answers to questions as follows:

- Q1 – Do you carry your payment card PIN code along with your payment card?
- Q2 – Have you ever changed your payment card PIN code?
- Q3 – Have you altered your payment card PIN code in a way that it would encode your date of birth?
- Q4 – Do you consider ATMs located at banks' premises safer for withdrawing your cash?

- Q5 – Do you have trust in the security of payment systems?
- Q6 – Do personal data represent information that needs to be most importantly protected?
- Q7 – Do you rely on the security measures of your bank in payment cards?
- Q8 – Are you sure that your bank takes proper care of your money?
- Q9 – Do you have any experience with a hacking attack or bank fraud?
- Q10 – Do you think that security measures taken to protect payment card data are continuously getting better?
- Q12 - How confident are you in the security of payment systems?
- Q13 – Do you think that the payment system carries elements of high security risks?
- Q18 – Does the enhanced security of new payment methods outweigh the cost of their implementation?
- Q19 – Does the enhanced customer convenience of new payment methods outweigh the cost of their implementation?
- Q20 - Why is it more challenging to secure payment card information?
- Q22 - How confident are you that customers can protect themselves when their personal information is lost or stolen?

The reliability of the research tool was judged by using the Cronbach's alfa coefficient. Its value was 0.81694. Based on the latter value, it is possible to state that it is not necessary to increase the value by removing any of variables. As the Cronbach alfa exceeds the value of 0.7, we can state that the research tool is reliable, and we can safely process the data.

The method is foremostly aimed at simplifying the description of group with mutual linear dependent signs, i.e. decomposing the source data matrix into structural and noise matrices. Each of main components represents a linear combination of original signs. Main components are ordered in line with their importance, i.e. with the decreasing dispersion (Tab. 1). This implies that a major portion of information on variability of original data is concentrated in the first main component and just as much information is concentrated in the last main component.

**Table 1.** Table of original values in the source matrix of researched set

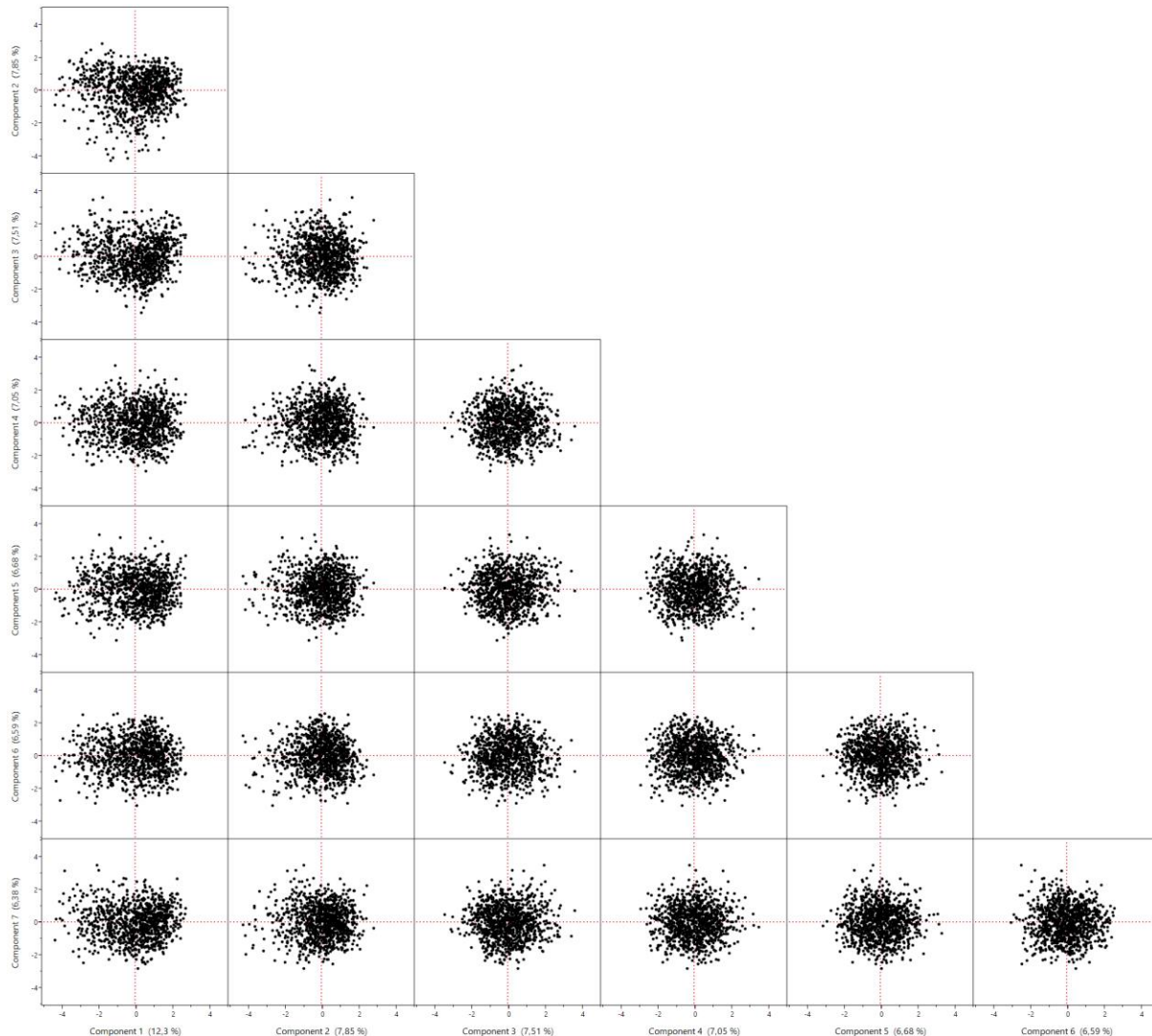
Value number	Eigenvalues of correlation matrix, and related statistics			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	1,971471	12,32169	1,97147	12,3217
2	1,255233	7,84521	3,22670	20,1669
3	1,202084	7,51302	4,42879	27,6799
4	1,128291	7,05182	5,55708	34,7317
5	1,069369	6,68356	6,62645	41,4153
6	1,054192	6,58870	7,68064	48,0040
7	1,020088	6,37555	8,70073	54,3795



8	0,971202	6,07001	9,67193	60,4496
9	0,932597	5,82873	10,60453	66,2783
10	0,858880	5,36800	11,46341	71,6463
11	0,838353	5,23971	12,30176	76,8860
12	0,827242	5,17026	13,12900	82,0563
13	0,806948	5,04343	13,93595	87,0997
14	0,772271	4,82669	14,70822	91,9264
15	0,706586	4,41616	15,41481	96,3425
16	0,585192	3,65745	16,00000	100,0000

*Source: Own study*

The table of original values in source data matrix (Tab 1) shows that the concentrations of first, second, third, fourth, fifth, sixths and seventh main components are 12.32169 %, 7.84521 %, 7.51302 %, 7.05182 %, 6.68356 %, 6.5887 %, and 6.37555 % of variability of the original data, respectively. These seven main components, whose own number is larger than 1 concentrate within themselves 54.3795 % of variability of original data of the researched set. The diagram of the dispersion measures (Fig. 5) shows that the first main component divides the responses by vertical axis into two clusters, while at negative values of the component score of the first main component, the responses to 16 of posed questions (Q1 - Q10, Q12, Q13, Q18 – Q20 and Q22) are homogenous. As opposed to the latter, at positive values of component score of the first main component, the responses are more heterogenous. In combinations of second, third, fourth, fifth, sixth and seventh main components, the data are concentrated around the centre of the coordinate system and yield a homogenous structure in all directions.



**Figure 5.** Dispersion diagram of component score

*Source: Own study*

The appropriate use of factor analysis is tested by Kaiser-Mayer-Olkin statistics and Bartlett's test of sphericity. KMO statistics represents an index which serves for comparing the size of experimental correlation coefficients against the size of partial correlation coefficients. When the sum of squares of partial correlation coefficients between all pairs of signs is small in comparison to the sum of squares of pair correlation coefficients, the measure of KMO statistics approaches the value of 1. Low values of KMO statistics indicate that the factor analysis of original signs would not be a good approach because the correlation between the pairs of signs cannot be explained by means of the rest of signs. In accord with the value of Keiser-Mayer-Olkin statistics (0.642) and definition by Kaiser, it is possible to state that based on the used research tool, the measure of correlation is good and the choice of factor analysis for security of payment system is justified. Bartlett's test of sphericity represents a statistical test of correlation between original signs. It tests the null statistic hypothesis  $H_0$ , namely whether "the correlation between the signs does not exist", i.e. whether the correlation matrix is a unit matrix. The achieved level of significance of Bartlett's test of sphericity  $p = 0.000$  is lower than the level of significance chosen by us ( $\alpha = 5\%$ ). Thus, we can reject the null hypothesis that the realisation of the selected correlation matrix with 16

considered variables is a unit matrix. Hence, to start off, we can state that the factor analysis is appropriate for the data dealing with security of payment system.

**Table 2.** Assumptions for the use of factor analysis (KMO statistics, Bartlett's test)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,642
Bartlett's Test of Sphericity	Approx. Chi-Square	629,915
	df	120
	Sig.	0,000

Source: Own study

The first step to the interpretation of results of factor analysis is to analyse the factor matrix (Tab. 3) which serves for gaining the initial number of factors. The factor matrix contains factor loading for each sign, while in each factor, it represents the best linear combination of original signs while including the highest possible number of variability of signs. The first factor is always the most important because it represents the best linear relation found in original signs. The second factor represents the second best linear relation of original data, however it is restricted by a condition that it has to be orthogonal to the first factor. The factor loading explains the role of each original sign in defining the common factor. It is, in fact, a correlation coefficient between every original sign and factor.

**Table 3.** Factor loading

Variable	Factor Loading (Varimax normalized) Extraction: Principal components						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Q1	0,667027	-0,056201	-0,009635	-0,057215	-0,047914	0,043137	-0,028946
Q2	-0,702289	-0,104631	0,149141	0,124769	-0,036834	0,127380	-0,138716
Q3	0,667834	0,008599	-0,008697	0,068546	0,022302	-0,218077	0,061900
Q4	0,030219	0,678758	-0,245063	0,044069	-0,098954	0,045068	0,133751
Q5	0,019901	-0,140903	0,650951	-0,000812	-0,066915	0,115440	0,296767
Q6	0,049937	-0,040089	0,062699	0,054951	0,009874	0,030645	0,783608
Q7	-0,014691	-0,126738	-0,064008	-0,134143	-0,056402	-0,732862	-0,095482
Q8	0,217457	0,031563	-0,055021	0,084674	0,078457	-0,654224	0,092631
Q9	-0,170928	0,049245	-0,095052	0,580158	0,203906	-0,203738	0,052174
Q10	-0,483641	0,224774	0,010966	-0,129255	-0,019166	-0,117729	0,352577
Q12	-0,202965	0,096779	0,555906	-0,202640	0,115733	0,055215	-0,145093
Q13	-0,062923	0,535860	0,004331	-0,038624	0,076363	0,080119	-0,338568
Q18	-0,031518	0,614785	0,422922	0,040299	0,008766	-0,002696	0,019843
Q19	0,055803	-0,088242	0,361737	0,298743	-0,592838	-0,237350	-0,194491
Q20	0,048449	-0,076490	0,168337	0,176893	0,804773	-0,122083	-0,100801
Q22	0,076839	0,000956	-0,051205	0,730203	-0,096729	0,236042	0,006834
Expl.Var	1,756082	1,254472	1,176141	1,104870	1,097575	1,238837	1,072751
Prp.Totl	0,109755	0,078404	0,073509	0,069054	0,068598	0,077427	0,067047

Source: Own study

The Table 3 makes it obvious that the first factor significantly correlates with components of research tool, namely with Q1 (Do you carry the payment card PIN code along with your payment card?), Q2 (Have you ever changed your payment card PIN code?), and Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth?). The values of factor loading reach the values of 60.7027 % and 66.7834 at components Q1 and Q3, respectively. The positive sign of factor loading reflects the indirect proportion, i.e. the evaluation of responses decreases on Likert scale with an increase in the number of respondents. Thus, in frame of the scale value, the responses stating “certainly not” or “no” are chosen. The factor loading of Q2 component of the research tool reaches the value of -70.2289. As it implies further from the analysis of Table 3, 44.4925 % of variability of Q1 component (“Do you carry the payment card PIN along with your payment card”), 49,321 % of variability of component Q2 (“Have you ever changed your payment card PIN?”) and 44, 6002 % of variability of component Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth? ”) are explained by the first mutual factor. The second mutual factor correlates with the component Q4 (Do you think that ATMs located at banks’ premises are safer for withdrawing your cash”), Q13 (“Do you think that the payment system carries elements of high security risks?”) and Q18 (“Does the enhanced security of new payment methods outweigh the cost of implementation?”) with the value of factor loading of 67.8758 % at component Q4, 53.586 % at component Q13, and 61.4785 % at component Q18. This implies that 46.0712 % of variability of component Q4, 28.7146 % of component Q13, and 37.7961% of variability of component Q18 are explained by the second mutual factor. The third mutual factor significantly correlates with the components Q5 (“Do you have trust in the security of payment systems?”) and Q12 (“How confident are you in the security of payment systems?”) with values of factor loading of 65.0954 % and 55.5906 %. From Table 3, it further implies that the variability values of 42.3737 % and 30.9031 % of Q5 and Q12 components, respectively, are explained by third mutual factor.

The fourth mutual factor correlates with components Q9 (“Do you have any experience with a hacking attack or bank fraud?”) and Q22 (“How confident are you that customers can protect themselves when their personal information is lost or stolen?”) with values of factor loading of 58.0158 % at Q9 component and 3.0203 % at Q22 component, which represents the values of 33.6583 % and 53.3196 % of variability of these components explained by the fourth mutual factor. The fifth mutual factor correlates with components Q19 (“Does the enhanced customer convenience of new payment methods outweigh the cost of implementation?”) and Q20 (“Why is it more challenging to secure payment card information?”) with factor loading values of -59.284 % and 80.4773 %, which represent the variability values explained by fifth mutual factor, namely those of 35.1457% and 64.766 % of Q19 and Q20 components, respectively. The sixth mutual factor correlates with components Q7 (“Do you rely on the security measures of your bank in payment cards?”) and Q8 (“Are you sure that the bank takes proper care of your money?”). The factor loading values are -59.284 % and -65.422 % for Q7 and Q8 components of research tool, respectively. Both components yield a negative degree of correlation. The last, seventh extracted factor correlates with Q6 component (“Do personal data represent information that needs to be most importantly protected?”) with factor loading value of 78.3608 % which represents a variability of 61.4041 % of this component explained by seventh mutual factor. Aside from defining the basic mutual correlations, we have at the same time tested the practical significance of factors.

Based on the facts mentioned above, the factors of the main research objective, defined as a restriction of main identifiers of the security of payment systems and secure behaviour of respondents, can be postulated as follows:

- Factor 1 – PIN code
- Factor 2 – Awareness of security risks,
- Factor 3 – Knowledge of security elements,
- Factor 4 – Personal experience with fraud,
- Factor 5 – Enhancement of security of payment systems,

- Factor 6 – Trust in banks
- Factor 7 – Need of protecting the security elements.

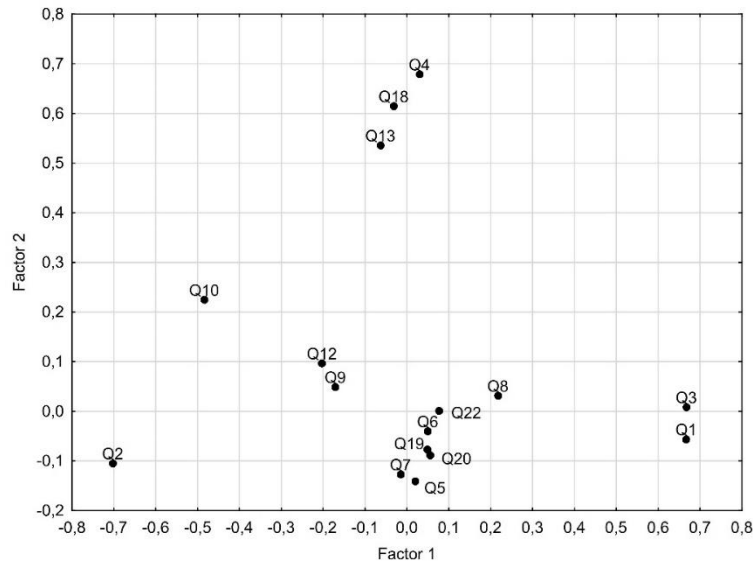
The factor analysis focuses foremostly on parameters of the factor model. It may require estimations of mutual factors, which is referred to as factor score. The values of mutual factors in  $n$  selected observed objects or observations are not only a useful tool for diagnosing the data, but possibly also an important entry into further analyses. The factor score is not an estimation of parameters in common sense because it involves estimations of values of non-observed quantities. The estimations of factor score for a given object can be imagined as its coordinates in R-dimensional space.

**Table 4.** Coefficients of factor score

Variable	Factor Score Coefficients Rotation: Varimax normalized Extraction: Principal components						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Q1	0,403974	-0,013833	0,052359	-0,061879	-0,025194	0,116074	-0,046696
Q2	-0,398755	-0,128143	0,058275	0,125695	-0,041488	0,025549	-0,119585
Q3	0,375695	0,057193	0,070984	0,054799	0,030542	-0,108248	0,042342
Q4	0,027875	0,548057	-0,210160	0,038413	-0,103424	0,005812	0,141195
Q5	0,072687	-0,104559	0,553875	0,010329	-0,027592	0,069398	0,255593
Q6	0,015465	-0,015685	0,039837	0,040412	0,018702	0,018291	0,727772
Q7	-0,102795	-0,061977	-0,027040	-0,115261	-0,078224	-0,606415	-0,076729
Q8	0,050911	0,078406	0,009138	0,079014	0,053975	-0,524822	0,092201
Q9	-0,137283	0,047838	-0,066609	0,528113	0,171820	-0,190067	0,054055
Q10	-0,301059	0,168865	-0,042920	-0,110880	-0,033603	-0,173483	0,350339
Q12	-0,045912	0,066089	0,467854	-0,163334	0,123199	-0,001508	-0,140003
Q13	0,011815	0,417752	0,011906	-0,024544	0,064394	0,035366	-0,305297
Q18	0,054389	0,502483	0,376989	0,055539	0,018987	-0,064813	0,019703
Q19	0,023964	-0,043568	0,321691	0,283831	-0,534320	-0,225482	-0,197507
Q20	0,049374	-0,056303	0,197145	0,166662	0,740724	-0,074662	-0,096994
Q22	0,055867	-0,000993	-0,032630	0,656919	-0,080331	0,198365	-0,007713

Source: Own study

Graphical representation of the relations between individual components of research tool and extracted factors 1 and 2 are shown in Figure 6. The latter figure makes it obvious that Q1 and Q3 components correlate positively with Factor 1, while the Q2 component correlates negatively with the latter factor. Q4, Q13 and Q18 components strongly and positively correlate with Factor 2 while their relation to Factor 1 is moving in a narrow interval from -0.1 to +0.1. In a particular manner, Q10 component also correlates with Factor 1, however the value of factor loading in relation to Factor 1 is lower than 0.5.

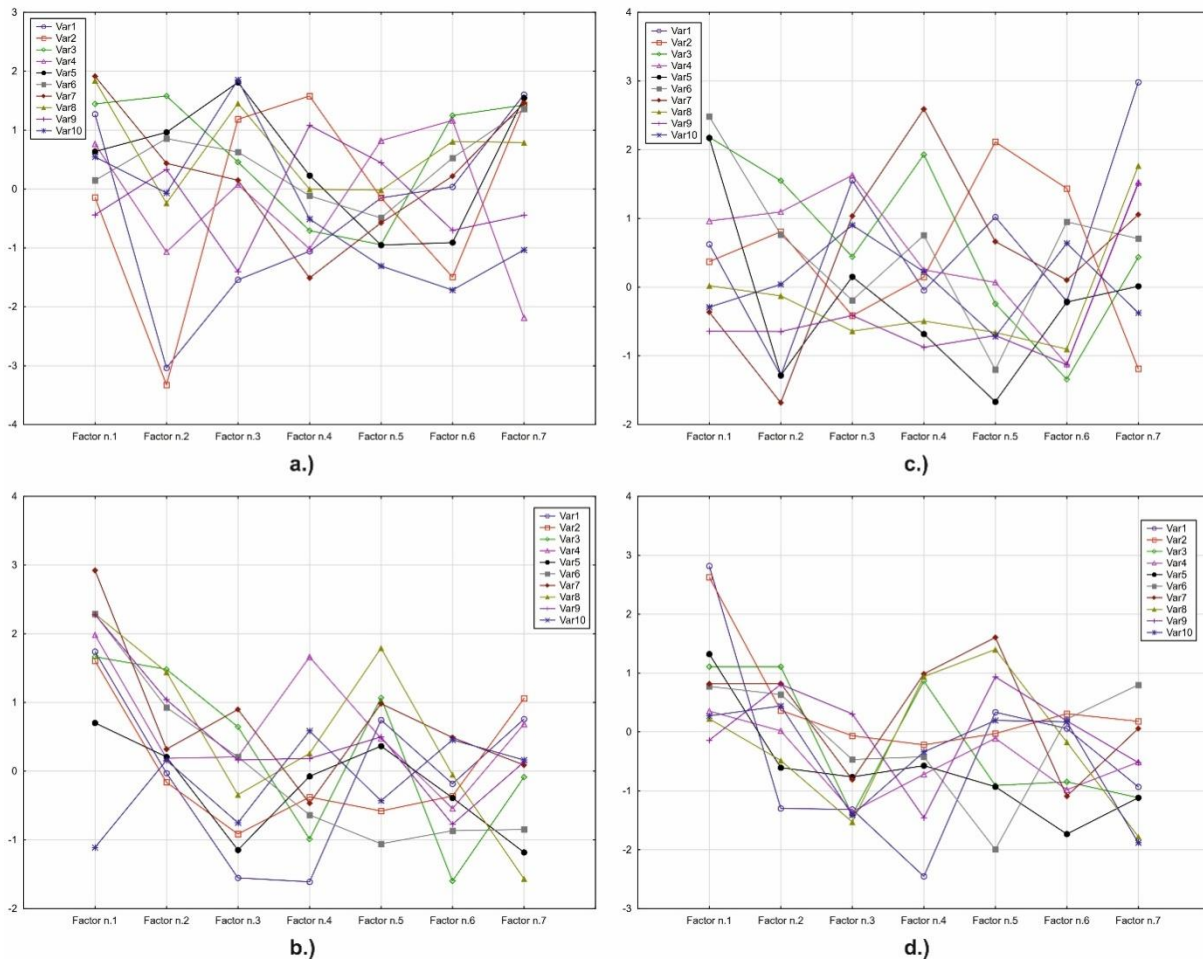


**Figure 6.** Graph of dependencies of the components of research tool on factors 1 and 2

*Source: Own study*

The graph of factor score for individual extracted factors is shown in Figure 7. For better illustration and transparency, always the first ten respondents of selected groups are depicted.





**Figure 7.** Graph of factor score for individual extracted factors

a) man, 31-4 years of age, secondary education; b) man over 60 years of age, secondary education; c) woman over 60 years of age, secondary education

*Source: Own study*

The Figure 7 depicts the factor score for the first ten respondents. It shows that at Factor 1 (defined as PIN code and observed to be correlating with Q1, Q2 and Q3 of the questionnaire), we see a positive perception in both women and men at 31-40 years of age, which means that the latter respondents attach importance to the rules for using the PIN code. A similar trend in Factor 1 can be seen also in men and women over 60 years of age, however this age category yields higher absolute values of the factor score. As to Factor 2 (defined as awareness of security risks), men and women at age of 31-40 years respond similarly on both poles, even though in both groups particular extreme values can be found. In the category over 60 years of age, the respondents of both genders are leaning towards positive values of the factor score. The presented analyses enable us to reason that the responses relating to the security of payment systems differ in the categories of 31-40 years of age and over 60 years of age, however an obviously similar trend in the distribution of factor score can be seen when comparing men and women. This means that the opinion about the security of payment systems is not influenced by gender.

## Conclusions

It is of importance to state that a conclusion laid out in greater detail would require the questionnaire to be further analysed while the conclusions implying from age differences as well as gender similarities in respondents' opinions about the security of payment systems would have to be further statistically tested.

The professionalisation of threat sources has led to increased sophistication of offensive technical tools, some of which are automated and deployed on a large scale for maximum impact, while others are carefully tailored to specific valuable targets and to evade detection and attribution. Malicious codes are used to stealthily penetrate information systems, monitor them and then extract confidential data such as trade or political secrets over extensive periods of time (called Advanced Persistent Threat, "APT"). Botnets comprising thousands to millions of infected computers and devices can be rented to perform denial of service attacks in order to blackmail their owner or to express discontent. Social engineering techniques are also very common, for example through emails that look legitimate but enable the attacker to steal credentials or penetrate the user's system ("phishing").

Financial public and private sector organisations are progressively recognising the scale of the challenge and adjusting their practices. In particular, an increasing number of top senior executives in large financial firms understand that a purely technical approach is insufficient to manage digital security risk. However, many public and private organisations, and in particular small and medium enterprises (SMEs), are not yet ready to manage digital security risk from an economic perspective and still consider this issue as mainly technical. Finally, the increasing number of massive data breaches exposing personal data and leading in some cases to financial fraud and identity theft raises concerns among individuals who are often left on their own, without the means, knowledge and skills to effectively manage this risk.

## References

- Ashford, W. (2013), Targeted cyber espionage on the increase, McAfee warns, [www.computerweekly.com/news/2240185167/Targeted-cyber-espionage-on-the-increase-McAfee-warns](http://www.computerweekly.com/news/2240185167/Targeted-cyber-espionage-on-the-increase-McAfee-warns).
- Aven, T. (2012). The risk concept - historical and recent development trends, *Reliability Engineering & System Safety* 99: 33–44. <http://dx.doi.org/10.1016/j.ress.2011.11.006>.
- Dobrovič, J., Gombár, M., Benková, E. (2017). Sustainable development activities aimed at combating tax evasion in Slovakia. *Journal of Security and Sustainability Issues*, 6(4): 761-772. [https://doi.org/10.9770/jssi.2017.6.4\(19\)](https://doi.org/10.9770/jssi.2017.6.4(19))
- Eurostat database (2012). Economy and finance. Retrieved from <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>
- Fechner, B. (2014), Les entreprises françaises face au défi de l'espionnage industriel, [http://lexpansion.lexpress.fr/actualite-economique/les-entreprises-francaises-peuvent-elles-relever-le-defi-de-l-espionnage-industriel\\_1633978](http://lexpansion.lexpress.fr/actualite-economique/les-entreprises-francaises-peuvent-elles-relever-le-defi-de-l-espionnage-industriel_1633978).
- Fuschi, D., Tvaronavičienė, M. (2014). Sustainable development, Big Data and supervisory control: service quality in banking sector, *Journal of Security and Sustainability Issues* 3(3): 5-14. [http://dx.doi.org/10.9770/jssi.2014.3.3\(1\)](http://dx.doi.org/10.9770/jssi.2014.3.3(1))
- Hajdu, Z., Andrejkovič, M., & Mura, L. (2014). Utilizing experiments designed results during error identification and improvement of business processes, *Acta Polytechnica Hungarica* 11(2): 149-166. <https://doi.org/10.12700/APH.11.02.2014.02.9>
- Jackson, W. (2014), "Cyber Espionage Incidents Triple: Verizon Report", [www.informationweek.com/government/cybersecurity/cyber-espionage-incidentstriple-verizon-report/d/d-id/1204612](http://www.informationweek.com/government/cybersecurity/cyber-espionage-incidentstriple-verizon-report/d/d-id/1204612)
- Jančíková, E., Veselovská, S. (2018). The new Technologies and the Fight Against Money Laundering and the Terrorism Financing. In *2nd International Scientific Conference - EMAN 2018 - Economics and Management: How to Cope With Disrupted Times*, Ljubljana - Slovenia, March 22, 2018, ISBN 978-86-80194-11-0. <https://doi.org/10.31410/EMAN.2018.334>

Jančíková, E., Pásztorová, J. (2018). Strengthened EU Rules to Tackle Money Laundering and Terrorism Financing and their Implementation in Slovak Republic. In Staničková, M., L. Melecký, E. Kovářová and K. Dvoroková (eds.). *Proceedings of the 4<sup>th</sup> International Conference on European Integration 2018*. Ostrava: VŠB - Technical University of Ostrava, 2018, pp. 528-536. ISBN 978-80-248-4169-4. ISSN 2571-029X.

Korauš, A.; Dobrovič, J.; Polák, J.; Backa, S. (2019a). Security aspects: protection of people in connection with the use of personal identification numbers, *Journal of Security and Sustainability Issues* 8(3): 319-330. [http://doi.org/10.9770/jssi.2019.8.3\(3\)](http://doi.org/10.9770/jssi.2019.8.3(3))

Korauš, A.; Gombár, M.; Kelemen, P.; Backa, S. (2019b). Using quantitative methods to identify insecurity due to unusual business operations, *Entrepreneurship and Sustainability Issues* 6(3): 1101-1012. [http://doi.org/10.9770/jesi.2019.6.3\(3\)](http://doi.org/10.9770/jesi.2019.6.3(3))

Kordík, M.; Kurilovská, L.; Intra Group Compliance Agreement as a tool to manage the risks in the daughter companies, *Entrepreneurship and Sustainability Issues* n. 4/2018, ISSN (online) 2345-0282 p.1008-1019, [https://doi.org/10.9770/jesi.2018.5.4\(21\)](https://doi.org/10.9770/jesi.2018.5.4(21))

Limba, T.; Šidlauskas, A. (2018). Secure personal data administration in the social networks: the case of voluntary sharing of personal data on the Facebook, *Entrepreneurship and Sustainability Issues* 5(3): 528-541. [https://doi.org/10.9770/jesi.2018.5.3\(9\)](https://doi.org/10.9770/jesi.2018.5.3(9))

Mamojka, M.; & Müllerová, J. (2016). New methodology for crisis management RM/RA CRAMM and its legal frame. In: Production management and engineering sciences. - Leiden: CRC Press/Balkema, 2016. pp 185-190. ISBN 978-1-138-02856-2.

Máté, D., Kiss, Z. (2017). An assessment of financial knowledge in higher education. *Acta Oeconomica Universitatis Selye* 6 (1): 83 – 98. ISSN 1338-6581

Mura, L.; & Vlacseková, D. (2018). Motivation of public employees: case study of Slovak teaching and professional staff. *Administratie si Management Public*, (31): 67-80. <https://doi.org/10.24818/amp/2018.31-05>

Müllerová, J. (2016). RM/RA CRAMM as a new risk management method for prevention of ecology disasters, 16th International Multidisciplinary Scientific GeoConference SGEM 2016, SGEM2016 Conference Proceedings, June 28 - July 6, Book5 Vol. 1, pp. 607-612. ISBN 978-619-7105-65-0 / ISSN 1314-2704

Müllerová, J.; & Mamojka, M. (2017). Legal possibilities of the rescue forces during the emergency event. In: SGEM2017 Conference Proceedings, 29 June - 5 July, 17(51): 605-612, ISBN 978-619-7408-08-9 / ISSN 1314-2704. DOI: [10.5593/sgem2017/51/S20.079](https://doi.org/10.5593/sgem2017/51/S20.079)

Okoro, E. G., Ekwueme, C. M. (2018). Determinants of bank performance in Nigeria: the dynamics of internality and externality measures. *Acta Oeconomica Universitatis Selye* 7(1): 108 – 120. ISSN 1338-6581

Roth V.; & Richter, K. (2006). "How to Fend off Shoulder Surfing," *Journal of Banking and Finance*, 30(6): 1727-1751. ISBN:1-58113-961-6 <https://doi.org/10.1145/1030083.1030116>

Skvarciany, V., Jurevičienė, D., Iljins, J., & Gaile-Sarkane, E. (2018). Factors influencing a bank's competitive ability: the case of Lithuania and Latvia. *Oeconomia Copernicana*, 9(1): 7-28. <https://doi.org/10.24136/oc.2018.001>

Šišulák, S. (2017). Userfocus - tool for criminality control of social networks at both the local and international level, *Entrepreneurship and Sustainability Issues* 5(2): 297-314. [https://doi.org/10.9770/jesi.2017.5.2\(10\)](https://doi.org/10.9770/jesi.2017.5.2(10))

Štitilis, D.; Pakutinskas, P.; Laurinaitis, M.; & Malinauskaitė, I. (2017). A model for the national cyber security strategy. The Lithuanian case. *Journal of Security and Sustainability Issues* 6(3): 357-372. [https://doi.org/10.9770/jssi.2017.6.3\(3\)](https://doi.org/10.9770/jssi.2017.6.3(3))

Štitilis, D.; Pakutinskas, P.; Kinis, U.; & Malinauskaitė, I. (2016) Concepts and principles of cyber security strategies, *Journal of Security and Sustainability Issues* 6(2): 197-210. [https://doi.org/10.9770/jssi.2016.6.2\(1\)](https://doi.org/10.9770/jssi.2016.6.2(1))

Tari F., Ozok A., & Holden S., (2006). "A Comparison of Perceived and Real Shoulder-Surfing Risks between Alphanumeric and Graphical Passwords," In *Proceedings of the Second Symposium on Usable Privacy and Security*, Pittsburgh, pp. 56-66. ISBN: 1-59593-448-0 [doi>10.1145/1143120.1143128](https://doi.org/10.1145/1143120.1143128)

Tvaronavičienė, M. (2018). Towards sustainable and secure development: energy efficiency peculiarities in transport sector, *Journal of Security and Sustainability Issues* 7(4): 719-725. [https://doi.org/10.9770/jssi.2018.7.4\(9\)](https://doi.org/10.9770/jssi.2018.7.4(9))

Tvaronavičienė, A., Žemaitaitienė, G., & Bilevičienė, T. (2016). Ecosystem for sustainable entrepreneurship: towards smart public procurement review procedures. *Entrepreneurship and Sustainability Issues* 4(1): 39-52. [http://dx.doi.org/10.9770/jesi.2016.4.1\(4\)](http://dx.doi.org/10.9770/jesi.2016.4.1(4))

Vlacseková, D.; & Mura, L. (2017). Effect of motivational tools on employee satisfaction in small and medium enterprises. *Oeconomia Copernicana*, 8(1): 111-130. <https://doi.org/10.24136/oc.v8i1.8>

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## TECHNOLOGY AND SUSTAINABLE DEVELOPMENT: TOWARDS THE FUTURE?

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**Abstract.** Sustainable development, care for the common good, debates on the challenges of civilization connected with the transformations of society and economies taking place under the influence of the technological factor belong to the issues most commonly covered by social researchers. The advent of the civilization of the future is becoming the much looked forward to conceptual revolution. Technology, technical innovations, technological principles are listed among the range of factors supposed to affect the future condition of the collectivity termed society today. Modern technologies are defined in categories of factors designed to genuinely affect the processes of the social construction of certain narrations of sustainable development. Authors endeavour to shed a light on the controversial role of technology in the process of the social construction of the premises of the conception of sustainable development. Technology alters the way we define the approach to valuating the issue of development in an increasingly complex world, in which it is becoming a difficult task to indicate the universal foundations of the emerging civilization of the future. Will the idea of the common good prevail over the ideological vision of a technological society based on strictly rational values of maximization?

**Keywords:** sustainable development; technology; technological society; values, risk; common good; social networks

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**JEL Classifications:** A14, B55.

**Additional disciplines** (besides field of economics reflected in JEL classifications): sociology.

### 1. Introduction

Over the recent years there has been a visible change in the way of thinking about socio-economic development connected with the return to the idea of the common good. A symbol of this semantic transformation is popularizing the slogans referring to the care for the natural environment and humanistic values (Beck 1995; 1997a). Development trends, whose direct implication has become excessive exploitation of nature, maximization of world consumption, are being questioned today by experts pointing out the social costs of these processes. The



care for the future, for the common good of future generations is beginning to be defined by social researchers in terms of civilizational challenges. Ecological problems treated as direct implications of unchecked technological advancement, devoid of any reflection on the condition of civilization, are tackled by representatives of all science disciplines (Jucker, Mathar 2015; Ul Haque 2019; Tkachenko et al. 2019; Polozova et al. 2019; Smaliukienė, Monni 2019).

The first debates from the 1960s and 70s concerned the form and scope of the degradation of the natural environment (Carson 1962). The 1980s saw the emergence of world ecologism, combining the issues of nature conservation and social development (Slovic et al. 1980, pp. 181-213). In the 1990s scientists began to raise the issues of the greenhouse effect and the ozone hole (Luhmann 1990). This period witnessed a significant change of environmental and economic policy of the most developed countries of the world. The conception of sustainable development is currently acquiring an axiological status on a global scale. A change of the development paradigm is occurring alongside the creation of new social conceptions connected with the evaluation of the new technologies and development trends. Technology development is defined in social sciences in the terms of a key factor affecting the qualitative changes taking place in the crucial spheres of life. The process of technicization of a social world is accompanied by a theoretical debate on its social costs (Betlej 2017, pp. 117-128).

Technological progressivism and the vision of the technological self-destruction of the known social order belong to the mainstream research into sustainable development. The theoretical contextualization of the relationship between the development of technology, knowledge and the social construction of specific narrations of a sustainable future is an extremely difficult task (Zacher 2013, pp. 182-198). The evaluation of technology, development risks, civilization threats, safety in an individual, social, cultural dimension requires a transdisciplinary approach (Menshikov et al. 2017, pp. 585-604). One discerns a need for a new way of thinking of the future of society defined as technological, digital or network one (Douglas 1966). It seems justifiable to pose questions about the social costs of the development of complex technological systems in the process of reproduction of social order, especially of political and economic systems (Carson 1962). Technological advancement is not assessed unambiguously. Many authors call attention to the negative effects of the development and popularization of technological innovations in the world (Coca et al. 2018, pp. 185-194). Knowing the essence of the relationship between technology and the idea of a sustainable future will enable researchers to unmask the crucial relationships of the invisible technological power bound up with the negative implications of technological advancement. The analysis of these multifaceted relationships will also indicate the directions of search for the network anti-power and the civilizational capabilities of technology which may become a tool for creating a sustainable future.

Technology is an example of space and a process that has undergone rapid transformations over the course of history. It should not be defined solely as an instance of an abstract category. In modern times, technology is assuming the form of a structuralized multilevel system (Zacher 2006). Technological rationality is different from social one. Technological systems ought to be considered in the context of the analysis of modern social transformations of a global significance as entities distinct from the well-known social systems (Zacher 2006, p. 156). The development of the new technologies is also connected with civilization development, advancement. It concerns implications of the development of technologies defined as network ones, which have brought about one of the greatest modern social transformations – the advent of the digital age and the economic dominance of the digital social formation (Castells 2009; 2012). The issue of the implications of these processes is an element of the research devoted to sustainable development. The properties of the new technologies establish the framework for the emergent social order, in which there is a clash between two axiological planes connected with the civilizational assessment of social sustainable development (Betlej 2015, pp. 2-17). A sustainable future is becoming the universal common good and ideology of the inhabitants of a digital world.

What is the role of the new technologies in the process of the social constructions of axiological narrations of sustainable development in a technological society? In what vision of the imagined future of society and



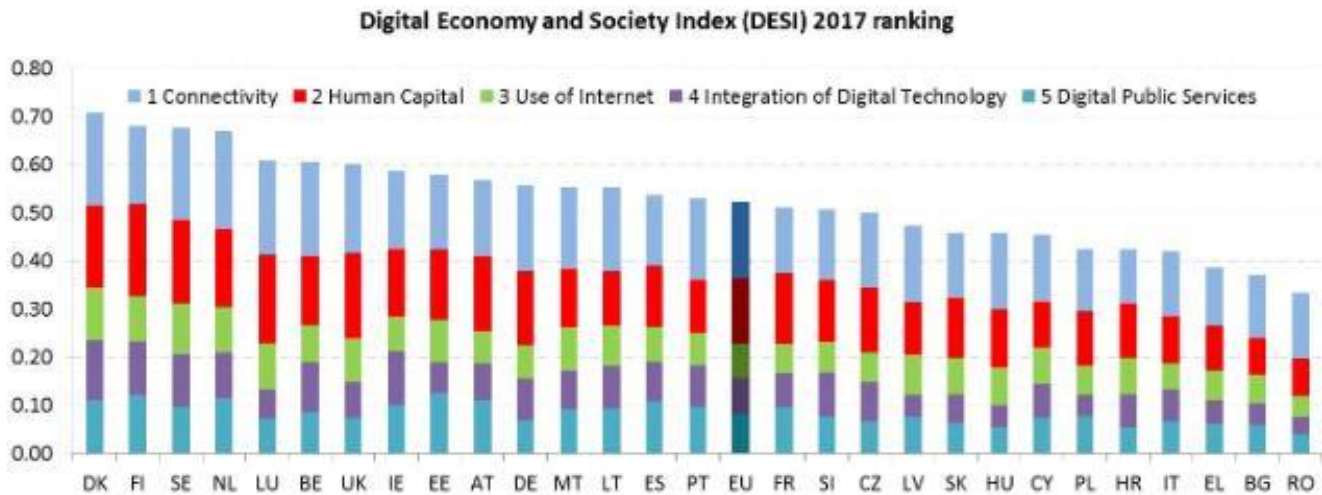
technology are we moving about nowadays? Fears of technological threats are ever more serious and it is technology that plays the role of the leading actor, an animated and fetished superstructure, finally, a real driving force in the process of social transformations (Zacher 2011). Can technology become an instrument of sustainable development, the application of which will provide the axionormative foundations for a safe, stable and predictable future? While talking about technological advancement, do we have in mind a real future or rather the present manifestations of the technological social order which may undergo self-destruction under the influence of seemingly rational social actions?

## **2. The future uncertain**

A technologically mediated future of the human civilization seems to be increasingly uncertain. The sustainable development of societies and economies building their success on the technological substrate of incomprehensible technological tools is endangered. Attention needs to be drawn to the fact of a close axiological link between technological and economic systems, a symbol of which is the global idea of maximizing development, profits, benefits, effects, goods, consumption, etc. Moral values, the common good, universal axionormative systems cease to be the aim of thus conceived progress. The technological mediation of social systems brings about axiological transformations of normative systems in many dimensions (Tvaronavičienė 2018). An example of this may be transformations of techno-social relations. Universal values, moral standards undergo the process of social redefinition. The propagated idea of being free to choose a set of moral values and principles stands in contradiction to the premises of the conception of sustainable development.

The future regarded as an example of a symbol of belief in the purposefulness of human actions is becoming epistemologically uncertain. The content that could give meaning to this conceptual notion-tool is beginning to be missing. The idea of maximizing and multiplying success which is possible to be achieved by virtue of the use of technological innovations appears to have negative consequences for the future society. The dominance of the technological imperative in a social world may result in permanent social changes, the greatest of which will be a loss of a sense of social agency and of subjectivity in a society dominated by machines. A contemporary manifestation of future problems are new areas of social technology-driven risk (Wichaisri, Sopadang 2017). An increasing degree of computerization of social life also affects the process of the technologization of social space and technicizing human activities.

The 2017 Digital Economy and Society Index (DESI) shows that the European Union is making progress in the process of technological- driven development. There is still seen a need for less digitalizes countries, as it is seen on the figure 1, to do more investments in technological innovations. Future is uncertain in the context of digital divides of contemporary societies. The technological development is a very abstract notion. The Digital Single Market for sustainable development still needs more efforts to be done by the main market's institutions. There is no "one" sustainable future for the whole world. New technologies brings different implications in countries on various stages of technological development.

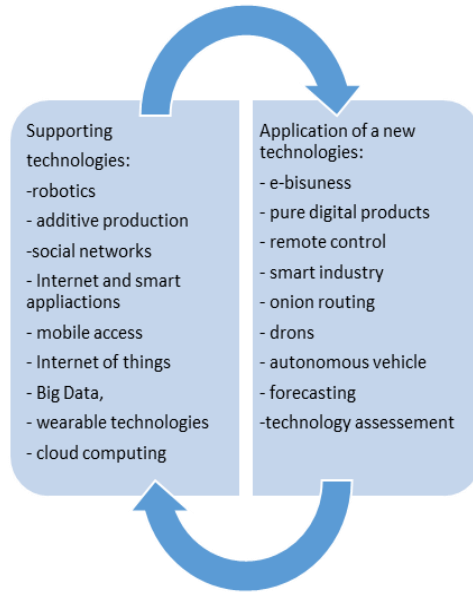


**Fig. 1.** Digital Economy and Society Index (DESI) 2017 ranking

Source: [http://europa.eu/rapid/press-release\\_IP-17-347\\_en.htm](http://europa.eu/rapid/press-release_IP-17-347_en.htm)

Technological rationality is ceasing to be contrasted with social rationality. Technological values significantly differ from social ones. Technology has a contextual, performative, progressive, totalizing character. Social values are universalizing (Zacher 2017, pp. 154-171). A technological way of thinking, connected with the development of specific technical devices (the mobile phone, laptop, tablet) is beginning to be prevalent in a society whose development is dependent on the new technologies. The stability of thus defined social order has a relative character. Social transformations in the dimension of man's biology, the way of life, of work, of running a business, science development, artificialization of the natural environment, controlling man's spirituality, constraining privacy stand in contradiction to the idea of enduring development (Rąb 2017, pp.172-186). The future of a technological society appears to be a technical construct created for the needs of promoting specific technological innovations (Lavrinenko et. al. 2016, pp.155-166). Ethical considerations encompassing the issues of transformations of human consciousness and a dominance of technological values in modern societies seem to be ingored by political decision makers (Vilčinskis et. al 2018, pp. 285-297).

There can be identified two specific kinds of technologies for sustainable development. The figure 2 point the attention at the problem of co-interactions between supporting technologies and applications of a new technologies. Ethical considerations usually encompass the problem of the nature of technologies. The same technologies could be used in a different way in contemporary societies. Technology for sustainable development can be transformed into the tool of uncertainty, war, and destabilization. Technologies are enhanced by the power potential which no neutral in the context of social technology assessment.



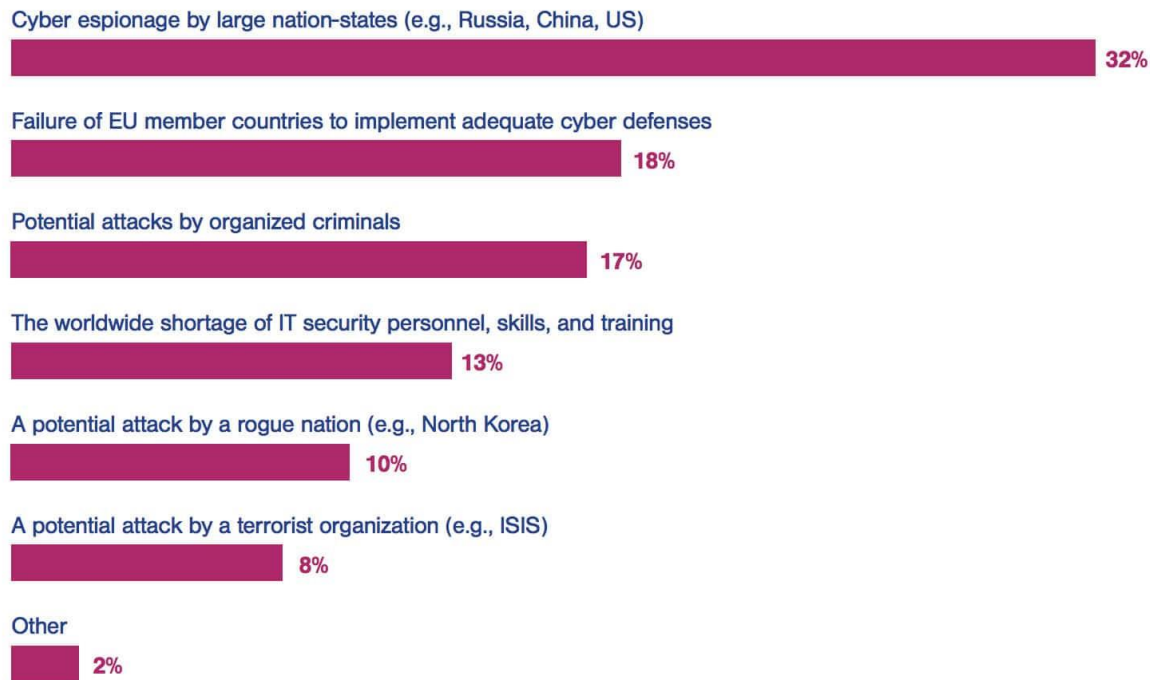
**Fig. 2.** Technological interactions

*Source:* Authors

The greatest threats of the unchecked development of the new technologies market for the idea of a sustainable future should be sought in a loss of control over the structures responsible for sustaining the social order (Davidavičienė et al. 2019). Radical transformations of social order may cause a disintegration of long duration structures, further increase of the significance of technological principles, atrophy of classical social relations in favour of the development of relational techno-systems as well as the development of new areas of technological risks. The global narration of a sustainable future seems to lose in the dispute with the technological idea of maximization. The right to privacy, anonymity and a freedom of communication, present in modern social debates, may be significantly redefined in the future. The freedom technologies are already today becoming an instrument of total control of a society dependent on technological solutions. A sustainable future is endangered also owing to the development of alternative social spaces in a digital world, such as Deep Web. Classical institutional structures, and in particular their social effectiveness, are more and more frequently questioned in the context of the emergence of new areas of threats.

## Greatest Cybersecurity Threat to EU Infrastructure

What is the greatest threat to the cybersecurity of EU critical infrastructure?



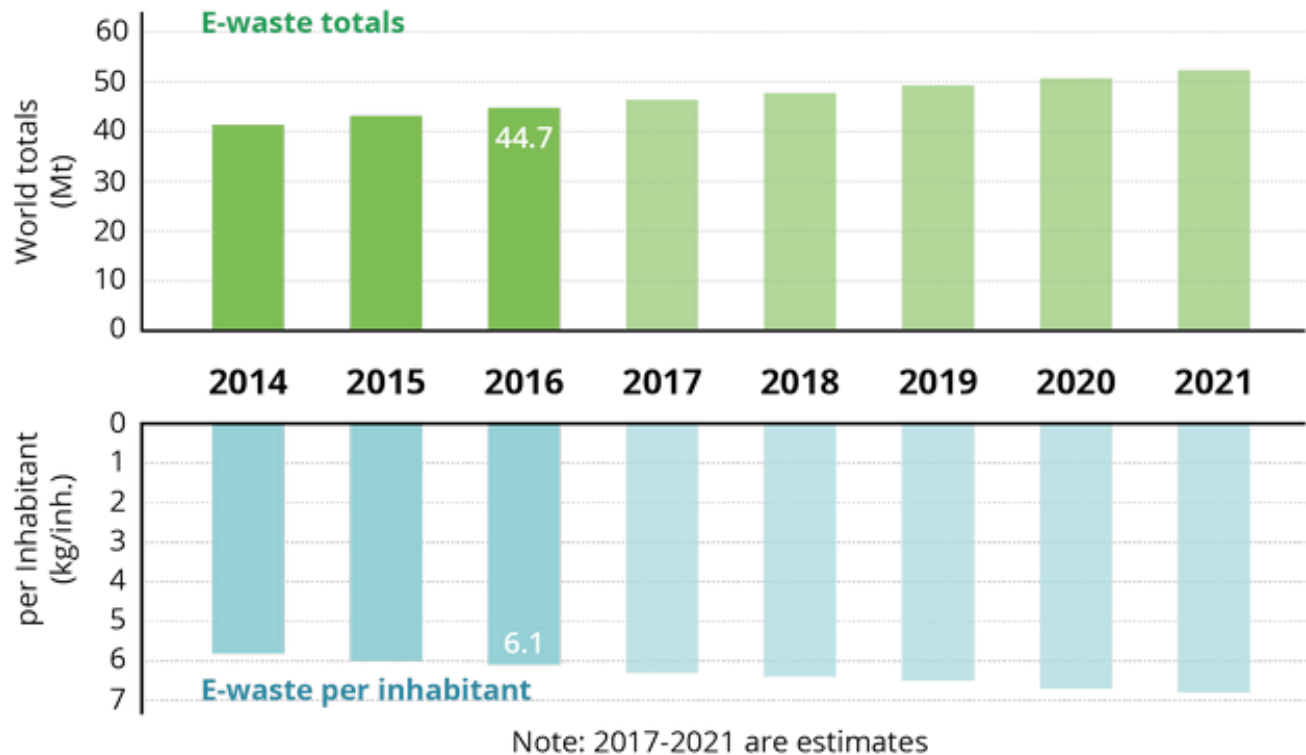
Data: UBM survey of 127 European IT and security professionals, September 2017

**Fig. 3.** Greatest Cybersecurity Threat to EU Infrastructure

Source: Cyberx (blog) <https://cyberx-labs.com/blog/black-hat-europe-attendees-speak-critical-infrastructure-attacks-imminent/>

Cybersecurity is one of the problems which are basically connected with the technology-driven sustainability issues. As it is mentioned on the figure 3, the general abstract of security is under deconstruction in theoretical analysis. The greatest threats for future social orders are connected with technological development in all aspects. Cybersecurity, what should be underlined, is not just a technological issue in contemporary societies. A prognosis could be made that in near future this problem will be one of the great importance in the context of sustainable development strategies.

Analysing the negative aspects of technological development for the natural environment, one cannot ignore the problem of recycling no longer needed technological devices. Excessive consumption in the sphere of technological gadgets, a total technicization of all aspects of human life result in the artificialization of the natural environment and production of techno-trash.



**Fig. 4.** Global E-waste Monitor 2017

Source: Global E-waste Monitor 2017

<https://www.itu.int/en/ITU-D/Climate-Change/Pages/Global-E-waste-Monitor-2017.aspx>

The growing amounts of electronic equipment consequently leads to greater amounts of e-waste as is it seen on the figure 4. “The Global E-waste Monitor 2017” provides the most comprehensive overview of global e-waste statistics. The magnitude of the e-waste problem in different regions will be in the next future the main problem to be solved in the policy of sustainable development. E-waste should be treated adequately to other types of “traditional” waste. It poses the same serious health issues since it contains hazardous components, including contaminating air, water, and soil, which seems not to be remembered by technological optimists claiming the digital era as the most fitted environment for humans in future. The new technologies are the factors of risk for people’s health.

More e-waste is thrashed then recycled which should bring us to make statesments about the need of a new e-waste policy in European Union. A statistical analysis of the scale of the phenomenon directs our attention to traditional problems of sustainable development. A conscious use of consumer goods and promotion of humanistic values still seem to be of essential significance for potential future social micro-revolutions, the aim of which will be to restore the significance of the conception of sustainable development. The concept of sustanibility needs a new policy on digitalization of natural environments and the emergence of a new problems for the future civilazation.

### 3. Social potential of the new technologies

The development of the new technologies is also bound up with great civilization hopes. The future is to be sustainable, intelligent and safe for society which will solve most of its existential problems thanks to technology. The belief in the technological power to overcome the ills of civilization such as poverty, hunger, hard labour, a too fast pace of life, diseases, social divisions is made very clearly in texts of social techno-progressivists. They highlight the self-organizational potential of the new technologies facilitating the maximization of the social capital of humanity in the future (Zacher 2007; 2012). For years, an unabated interest in this concept category has been connected with a growing need to make use of the resources (such as, among other things, trust, social and citizen activity) which individuals and local communities have at their disposal. At this juncture, the issue of particular interest is to find, first, the determinants of the occurrence of social capital resources in various age groups of the new technologies users, second, the relationship which holds between age and the socio-economic status and the disposition to generate one of the three types of social capital: bonding, bridging and linking (Adamczyk 2016, pp. 5-13). In particular, the development of information and communication technologies is to facilitate the formation of decentralized structures without a control centre (Menshikov et al. 2017, pp.585-604).

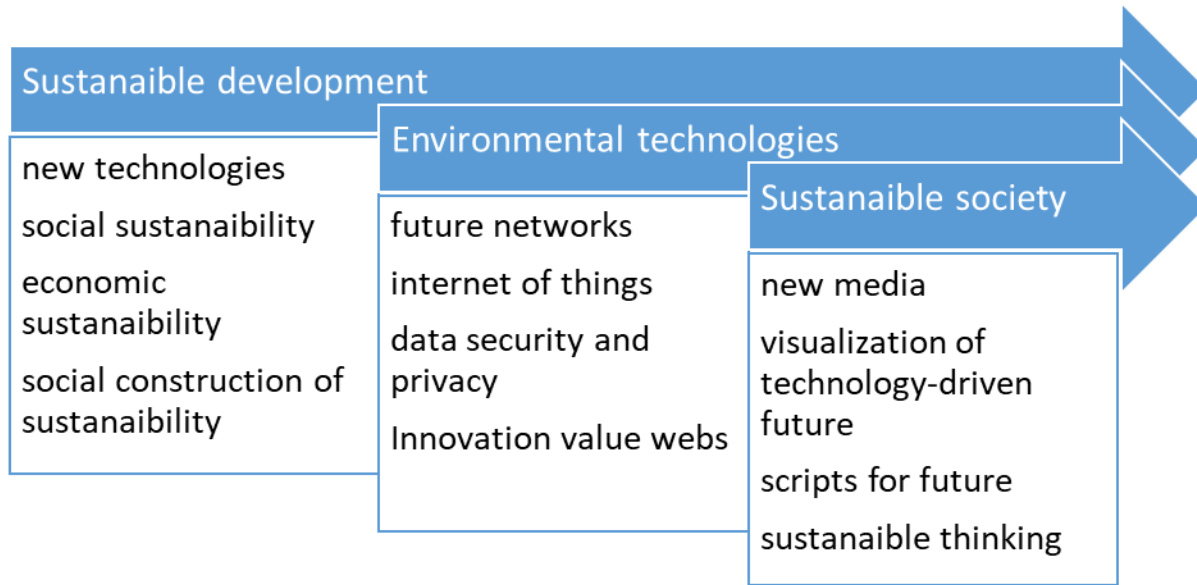
Technology may be treated as an instrument to create a moral order in the technologically mediated civilization on condition that humanistic values prevail in an epistemological confrontation with technological rules (Beck et al. 1994). The main constituents of a social order are ethical values, norms and patterns of actions as well as institutions creating the normative and institutional moral order (Adamczyk 2017, pp.66-77). The “epidemic of cooperation” raises great hopes of a stable development of a society of the future, which will enable the materialization of the idea of socially active entities shaping social reality in a conscious way. Can, however, the human capital be treated as a resource participating in shaping a new social and moral order in the society of the future? Social order is the manner in which a society is organized and functions based on principles and rules, which are enduring and consistent with one another. These rules must be respected for it is them that safeguard social cohesion and ensure the coordination of individual and collective activities. Society defined as technological also functions based on a certain form of potential order, which ensures the coordination of fulfilling individual and collective needs. The new technologies may assist in the process of a specific stabilization of social life undergoing relational atrophy (Gondek 2017, pp.87-97).

Europeans are told to be more digitalized in all aspects of their activities. Digital technologies are interpreted as the tools for collective actions and economic development. There is no way back from the ICT revolution. The question is if the digital technologies could be environmental. The emergence of the digital era could bring a solution for environment polity. New technologies will be applied in generating vast amounts of data which could help in better understanding the models of social and economic interactions in the process of building sustainable future. The Analytics’ applications and techniques of visualization can improve the process of conceptual framing the patterns for more sustainable behavior. The experts says, the digital revolution is the first step for:” [...] improving forecasts of natural events or disasters, optimizing global agricultural production and food supply, anticipating traffic congestion and managing low emission zones, limiting energy production up to the precise needs of consumers, discovering defects in, or imminent failure of specific product components, allowing preventative maintenance that avoids failure and more costly repair / replacement” (Tardieu 2014).

An important potential of technology is the possibility of using technical devices, machines, gadgets as tools counteracting social exclusion in the society of the future. The aging of societies is currently a process considered to be the universal trend in Western European countries. Population changes termed even as social ones bring qualitative changes in the manner of defining social exclusion. The consequences of the aging of societies raise numerous concerns about the future of European countries. Contemporary reality is undergoing rapid transformations in numerous areas. The ability to adjust to the ongoing changes is acquiring a civilizational significance. Full participation in the technologized socio-economic environment is possible only for individuals



having specific technical, social and psychological competences. The ability to use the new technologies is becoming a historical necessity. A consequence of the progressive technological development is, on the one hand, the emergence of new areas of social exclusion, however, the potential of technology is also noteworthy. An example of this may be the social exclusion of elderly people, which is tackled by the conception of sustainable development. Technology has never before been so friendly to man as it is nowadays.



**Fig. 5.** Directions for sustanaible based and technology-driven future.

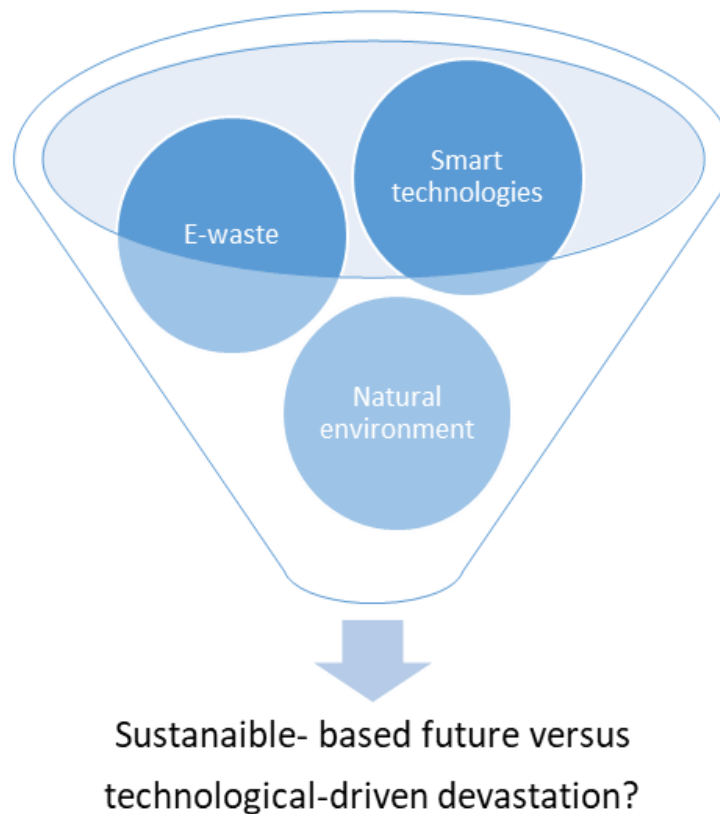
*Source:* Authors

As it is seen at figure, 5 the directions for sustanaible based and technology driven future are commonly accepted in the global debat. New technologies “are expected” to be smart, as well as natural environment and societies. The question is are we on the last mile to the smart civilization? Technologies are more environmental. What about the human factor? In the future, the new technologies may enable people to effectively prevent conflicts, terrorist attacks or other actions which are aimed at destabilizing social order in a global dimension. Technological products hold an essential potential for social control (Betlej 2018, pp. 38-47). Its ethical assessment also raises numerous controversies. Total control implies a loss of certain areas of freedom of activity of social actors. It is necessary to undertake multidimensional studies into mechanisms of creating new types of technologically mediated social control (Levidow 1998, pp. 211-226).

An ever increasing degree of complexity of the social world in technological civilization calls attention to the emergence of certain techno-social realities which may, to a certain extent, constitute the materialization of the idea of sustainable development. The processes of the formation and accumulation of social resources within the framework of technological systems require in-depth studies. The benefits resulting from technological development are significant in the context of creating scenarios for the future. However, each potential of the new technologies becomes a factor of social exclusion in other areas of human activity. Sustainable development, a crucial element of which, to an even greater extent, will be the new technologies, requires new management strategies (Beck 1997b).

## Conclusions

Theoretical deliberations on the essence of the new technologies in terms of creating potential scenarios of the development of a sustainable civilization of the future direct one's attention to several essential issues (compare with figure 6). In the first place, it is necessary to develop efficient solutions in the domain of predictive analytics. There is a discernible need to create tools facilitating the assessment of civilization risks, identification of social and economic problems, as well as the institutionalization, on new conditions, of the processes of solving the identified problems. Technological advancement is progressing at an ever greater rate; in his surroundings man creates too many innovations, information, data, the analysis of which is not possible without utilizing technological tools in analytical processes. A miscomprehension of the new technological solutions, despite the fact of using them in everyday life, results in man's increasing alienation in relation to the technologized reality, and consequently, in a loss of social agency. A sustainable technological future requires undertaking institutionalized actions facilitating an increase of the social awareness of the new technologies users. Long-term and sustainable development will be feasible only by virtue of restoring to social actors their natural subjectivity in relation to a hybrid techno-social world.



**Fig. 6.** Sustainable- based future versus technological-driven devastation.

*Source:* Authors

The challenge that sustainable future faces is solving the issues of the safety, freedom and privacy of the participants of a technologized world. The analysed issues of the dominance of technological principles over social ones require a special approach. The problem, often ignored in social debates, is of civilizational significance for the manners of overcoming these social dilemmas will condition future trends of development of a total or a responsible society.

Another technology pivotal for the future is the Internet. This solution will bring the greatest changes for the world economy and for the society of the future over the timespan of the next decades. Projects which use the potential of the Internet, things may be instrumental in accomplishing the Objectives of Sustainable Development established by the UN. This technology gives a promise of a qualitative increase based on the idea of sustainable development to less developed countries with a lower standard of living of the inhabitants.

There remains an unsolved issue of technological waste, rubbish, products unattractive to requiring customers. Are we, as a civilization, heading for the future? Does our development encompass an essential social objective, different from economic growth? The questions still remain open. Sustainable future is the goal promoted today, however, technology itself will not solve the problems resulting from a low awareness of the civilization threats connected with a broadly conceived devastation of the natural environment among the contemporary creators of the civilization of the future.

## References

- Adamczyk, M. 2016. Education in late adulthood as a form of social participation of older people, in: Mensikovs V. (ed. by) *Proceedings of the International Scientific Conferences of Faculty of Social Sciences of Daugavpils University. The materials of the International Scientific Conference*, Daugavpils Universitātes Akademiskais apgads "Saule", Daugavpils, 5–13.
- Adamczyk, M. 2017. Active and Healthy Aging as an Element of Social Integration of Older adults, in: Kinal, J.; Guz, (eds. by) W. *Spoleczne aspekty zdrowia: wybrane zagadnienia = Social aspects of health: selected issues*, Rzeszów: Stowarzyszenie Naukowe Przestrzeń Społeczna i Środowisko, 66–77.
- Beck, U. (eds.) 1997b. *Politik der Globalisierung*, Frankfurt am Main: Suhrkamp.
- Beck, U. 1995. *Ecological Politics in an Age of Risk*, Cambridge: Polity Press.
- Beck, U. 1997a. *Was ist Globalisierung? Irrtümer des Globalismus – Antworten auf Globalisierung*, Frankfurt am Main: Suhrkamp.
- Beck, U.; Giddens, A.; Lash, S. 1994. *The Reflexive Modernization: politics, tradition and aesthetics in the modern social order*, Cambridge: Polity Press.
- Betlej, A. 2014 (printed in 2015). Non-knowledge, Risk and Technology in Networked World-Towards the Future, *Transformacje. (Transformations)* 3-4 (82-83): 2-17.
- Betlej, A. 2017. Peril and Promise of Internet Technology for Future Social Order, in: Zacher L. W. (ed. by). *Technology, Society and Sustainability. Selected Concepts, Issues and Cases*, Springer, 117-128.
- Betlej, A. 2018. Society of e-control in Hyperconnected Reality, *Transformacje (Transformations)* 3-4 (94-95): 38-47.
- Carson, R. 1962. *Silent Spring*, Boston: Houghton Mifflin.
- Castells, M. 2009. *Communication power*, Oxford/New York: Oxford University Press.
- Castells, M. 2012. *Networks of Outrage and Hope. Social Movements in the Internet Age*. Cambridge: Polity Press.
- Cyberx (blog) Available: <https://cyberx-labs.com/blog/black-hat-europe-attendees-speak-critical-infrastructure-attacks-imminent/>

- Coca, J. R.; Caballero, I.; Carrera, F. J. F.; Paramá A. 2018. Technoscience, Hermeneutic and Society Oriented to the Person, *Filosofija Sociologija* 29(3): 185-194, <https://doi.org/10.6001/fil-soc.v29i3.3775>
- Davidavičienė, V., Raudeliūnienė, J., Tvaronavičienė, M., Kaušinis, J. 2019. The importance of security aspects in consumer preferences in electronic environment, *Journal of Security and Sustainability Issues* 8(3): 399-411. [http://doi.org/10.9770/jssi.2019.8.3\(9\)](http://doi.org/10.9770/jssi.2019.8.3(9))
- Digital Economy and Society Index (DESI) 2017 ranking. [Online] Available: [http://europa.eu/rapid/press-release\\_IP-17-347\\_en.htm](http://europa.eu/rapid/press-release_IP-17-347_en.htm) (26 March 2019).
- Douglas, M. 1966. *Purity and danger. An Analysis of Concept of Pollution and Taboo*, London: Routledge.
- Global E-waste Monitor 2017. [Online] Available: <https://www.itu.int/en/ITU-D/Climate-Change/Pages/Global-E-waste-Monitor-2017.aspx> (25 March 2019).
- Gondek, J. 2017. Sign-Technology-Simulation. Reflections on the Project of Jean Baudrillard's Research Method, *Transformacje (Transformations)*, 3-4 (94-95): 87-97.
- Jucker, R.; Mathar, R. (eds) 2015. *Schooling for Sustainable Development in Europe. Concepts, Policies and Educational Experiences at the End of the UN Decade of Education for Sustainable Development*, Springer.
- Lavrinenko, O., Ohotina, A., Tumalavičius, V., Pidlisna, O. V. 2016. Assessment of partnership development in cross-border regions' innovation systems (Latvia-Lithuania-Belarus), *Journal of Security and Sustainability Issues* 6(1): 155-166. [https://doi.org/10.9770/jssi.2016.6.1\(12\)](https://doi.org/10.9770/jssi.2016.6.1(12)).
- Levidow, L. 1998. Democratizing technology - or technologizing democracy? Regulating agricultural biotechnology in Europe, *Technology in Society* 20(2): 211-226.
- Luhmann, N. 1990. Technology, Environment and Social Risk: A Systems Perspective, *Industrial Crisis Quarterly* 4: 223-231.
- Menshikov, V., Lavrinenko, O., Sinica, L., Simakhova, A. 2017. Network capital phenomenon and its possibilities under the influence of development of information and communication technologies, *Journal of Security and Sustainability Issues* 6(4): 585-604. [https://doi.org/10.9770/jssi.2017.6.4.\(5\)](https://doi.org/10.9770/jssi.2017.6.4.(5))
- Polozova, T., Musiienko, V., Storozhenko, O., Peresada, O., Geseleva, N. 2019. Modeling of energy-saving processes in the context of energy safety and security, *Journal of Security and Sustainability Issues* 8(3): 387-397. [https://doi.org/10.9770/jssi.2019.8.3\(8\)](https://doi.org/10.9770/jssi.2019.8.3(8))
- Prakash, R., Garg, P. 2019. Comparative assessment of HDI with Composite Development Index (CDI), *Insights into Regional Development* 1(1): 58-76. [https://doi.org/10.9770/ird.2019.1.1\(5\)](https://doi.org/10.9770/ird.2019.1.1(5))
- Slovic, P., Fischhoff, B., Lichtenstein S. 1980. Facts and fears: Understanding perceived risk, in Richard C. Schwing and Walter A. Albers (eds.), *Societal risk assessment: How safe is safe enough?*, New York: Plenum, 181-213.
- Smaliukienė, R., Monni, S. 2019. A step-by-step approach to social marketing in energy transition, *Insights into Regional Development* 1(1): 19-32. [https://doi.org/10.9770/ird.2019.1.1\(2\)](https://doi.org/10.9770/ird.2019.1.1(2))
- Strogatz, S. 2003. *Sync: The Emerging Science of Spontaneous Order*, New York.
- Strydom, P. 2002. *Risk, Environment and Society: ongoing debates, current issues and future prospects*, Buckingham/Philadelphia: Open University Press.
- Tapscott, D.; Williams, A. D. 2010. *Wikinomics: How Mass Collaboration Changes Everything*, Paperback.
- Tardieu, H. 2014. Sustainability and Digital Revolution: A Winning Combination <https://atos.net/en/blog/sustainability-digital-revolution-winning-combination> (29 March 2019).

Tkachenko, V., Kwilinski, A., Korystin, O., Svyrydiuk, N., Tkachenko, I. 2019. Assessment of information technologies influence on financial security of economy, *Journal of Security and Sustainability Issues* 8(3): 375-385. [https://doi.org/10.9770/jssi.2019.8.3\(7\)](https://doi.org/10.9770/jssi.2019.8.3(7))

Tvaronavičienė, M. 2018. Towards internationally tuned approach towards critical infrastructure protection, *Journal of Security and Sustainability Issues* 8(2): 143-150. [https://doi.org/10.9770/jssi.2018.8.2\(2\)](https://doi.org/10.9770/jssi.2018.8.2(2))

Ul Haque, A., Kot, S., Imran, M. 2019. The moderating role of environmental disaster in relation to microfinance's non-financial services and women's micro-enterprise sustainability, *Journal of Security and Sustainability Issues* 8(3): 355-373. [https://doi.org/10.9770/jssi.2019.8.3\(6\)](https://doi.org/10.9770/jssi.2019.8.3(6))

Vilčinskas, V. 2018. Social Construction of Nuclear Risks: Analysis of Institutional Communicative Discourses on Astravets Nuclear Power Plant, *Filosofija. Sociologija* 29(4): 285-297. <https://doi.org/10.6001/fil-soc.v29i4.3855>

Zacher, L. W. 2006. *Gry o przyszłe światy (Games for the Future Worlds)*, Prognosis Committee „Poland 2000+”, Warsaw: PAN Scientific Publishing House.

Zacher, L. W. 2007. *Transformacje społeczeństw. Od informacji do wiedzy (Transformations of Societies. From Information to Knowledge)*, Warsaw: C.H. Beck Publishing House.

Zacher, L. W. 2012. Człowiek utecniczony i zwiirtualizowany w hybrydowym świecie (Technological and Virtualized Human in the Hybrid World), in Lech W. Zacher (ed.), *Wirtualizacja, problemy, wyzwania, skutki (Virtualization: Problems, Challenges, Implications)*, Warsaw: Poltext Publishing House.

Zacher, L. W. 2013. Reconfigurations in the World System - Between the Old Driving Forces and New Networks, *Transformacje (Transformations)* 3-4 (78-79): 182-198.

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## ASPECTS OF THE SECURITY USE OF PAYMENT CARD PIN CODE ANALYSED BY THE METHODS OF MULTIDIMENSIONAL STATISTICS\*

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**Abstract.** The conception of economic security management should be established on instruments and measures that will enable the financial institutions to operate in their interest without losing their financial stability, profitability and economic independence. This is a significant prerequisite for the security of the functional components of the company's financial security. The article presents an analysis of research results. Its objective is to contribute to the knowledge and understanding of the behaviour of payment card users with a special focus on the aspect of their security connected with the use of payment card personal identification number (PIN). The article analyses the opinions and attitudes of respondents toward the questions dealing with the security of payment cards and their behaviour when using them. The analysis is carried out from the aspect of gender, age and education of respondents by using multidimensional statistical methods, namely factor analysis and analysis of dispersion.

**Keywords:** economic security; PIN; financial security; security management; financial institution; security; payment cards

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**JEL Classifications:** F5, F52, K42, K24

**Additional disciplines** (besides field of economics reflected in JEL classifications): information and communication; security, protection of people and property

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## **1. Introduction**

Digital security threats and incidents have been intensified in recent years, thus leading to significant economic and social consequences for public and private organizations as well as individuals. Some examples include disruption of operations (e.g. through denial of service or sabotage), direct financial loss, lawsuits, reputational damage, loss of competitiveness (e.g. in case of theft of trade secret), as well as loss of customer trust. An increasing number of stakeholders are aware of the need of improving the management of digital security risk to reap the benefits of the digital economy.

Risk is the effect of uncertainties on objectives. Digital security risk is the expression used to describe a category of risks related to the use, development and management of the digital environment in the course of any activity. This risk can result from the combination of threats and vulnerabilities in the digital environment. They can undermine the achievement of economic and social objectives by disrupting the confidentiality, integrity and availability of the activities and/or environment. Digital security risk is dynamic in nature. It includes aspects related to the digital and physical environments, people involved in the activity and organisational processes supporting it.

The activities undertaken by companies in pursuance of their objectives are subject to factors that can have consequences on the likelihood of their success. Risk is the effect, or the consequence, of uncertainty on the objectives pursued by stakeholders, i.e., a deviation from their anticipated reality. Risk is often expressed in terms of likelihood and impact, while risk levels are typically represented on an X-Y axis, which helps in considering the various combinations of these two dimensions.

## **2. Theoretical background**

A number of scientists have devoted their works to the management of economic and financial security at the banking level (Jančíková, Pasztorová 2018; Jančíková, Veselovská 2018). Korauš et al. (2019a, 2019b) analyze the security of payment systems. Athanasoulis et al. (1999) seek to establish a link between the state of macro-markets and financial security. Delaquil et al. (2012) combine problems in assessing the level of economic, energy and climate security (Žulová et al. 2018) and confirm the need for integrated protection of the state security in various areas. Hacker et al. (2014) develop the methodological aspects to assess the level of the country's economic security. The authors suggest using an Economic Security Index while diagnosing the economic security state. They also justify the possibility of its application as a new measurement tool for research and analysis of state policy on the one hand, and as a new means of assessing economic security of American workers and their families, on the other. Klein (2009) establishes the relationship between the level of economic security and human well-being.

Awareness of security risks research Kordik and Kurilovská (2018), reliable risk assessment method RM/RA CRAMM applicable for a crime risk assessment was described by Mamojka and Mullerova (2017) and its legal questions by Mullerova and Mamojka (2017).

Managing the financial security of financial intermediaries has its own characteristics. Cybernetic security issues, which are often perceived as synonymous with the safety of critical infrastructure (Dobrovič et al., 2017). The problems of conceptualizing the management of economic and financial security of banking institutions are raised by European scientists. Namely, Jantoń-Drozowska and Mikołajewicz-Woźniak (2017); Shive and Forster (2017) specify the peculiarities of a fraud-monitoring organization within the system of economic security management of a banking institution. Baldwin et al. (2011); Mura et al. (2018) offer a methodical approach to the formation of organizational and economic support for the financial security management of banks. Novotný

(2015), Poliačiková (2017), Paulík et al. (2015) and Gaigaliene et al. (2018) studied the application of CSR measuring model in commercial banks in relation to their financial performance.

Banks currently use sophisticated tools to track and detect fraud and fight against them at every stage of the buying process, even before they buy. Banking experts are constantly expanding and enhancing technology to take a step forward from fraudsters, so that once MasterCard identifies smartphone clips as its own, no one else can shop with client mobile credentials. Card payer cardholders are also able to make safer digital payments even through tokenisation - the process of exchanging a token card master account number.

The smart cards are equipped with an additional security element, which is embedded in the form of an inserted microchip, safely storing user data.

The service provider is assigned or the user selects the Personal Identification Number (PIN) numbers that contain 3 to 6 digits. PIN numbers are typically associated with different types of banking services. If a user completes a transaction, it is a requirement for users to enter their PIN assigned to their account. User numbers will be verified based on saved numbers. Sometimes a dynamically generated number called a one-time password (OTP) can be used as a PIN. Although PINs are simple and effective in securing accounts, they are prone to attacking the shoulder. When attacking the shoulder surf, the attacker follows the user authentication process and identifies the PIN number. Using virtual keyboard shortcuts makes it easier for an attacker to make keyboard entries on the screen. A security precaution to prevent this attack ensures that no one is entered before the PIN is entered. But in public places such as ATMs, cyber cafes, department stores, etc. It's hard to push. Another option is to use OTP for transactions. However, additional costs and delays could arise. OTP attacks are also prevalent (Raddum et al. 2010).

In the case of a human arm attack, the attackers rely on their ability to observe and remember the details they have observed (Tari et al. 2006; Roth and Richter 2006; Por 2013; Malek et al. 2006; Horecký, 2018). When entering a PIN on a virtual keyboard, a user clicks the numbers one at a time and gives enough opportunity for the observer to see individual digits reconstruct the entire PIN. So any security mechanism that prevents direct entry of numbers and increases the trouble of the attacker tracking the pin input to track the real number is enough to alleviate attacks on the shoulder. But when the attack on the shoulder is surfing with a recording device such as a mobile camera or malware that could record video activity on the screen, it is very difficult to defend (Wu 2014). This is because the attacker could view the recorded video several times and reproduce the PIN number in succession. There are many suggestions to limit recorded attacks on the shoulder. Such models are more complicated for implementation and follow-up for regular users.

Recognizing the potential for PIN attacks during the PIN process, many scientists have focused on developing new schemes to mitigate these attacks. A survey of many virtual keyboards takes place in (Kölsch and Turk 2002). Method (Wilfong 1999) requires that the user performs a math operation on each digit of his / her random number PIN provided by the authenticators. The result is entered by the user. At the end of the server, the same digits are repeated to get digits. Verified based on actual saved PINs. This approach requires users a certain level of competence to perform mathematical computations, and may lead to several erroneous inputs.

In the mobile environment, there is a high risk of the observing attacks which is the way to steal a password, because many people have a camera-equipped mobile phone and a miniature camera. The biometric authentication technology is one of the methods to solve this problem. However, some equipment does not have the device of biometric authentication. Moreover, some system requires PIN or password when failing in the biometric authentication. The PIN or password authentication is still used widely (Fujita, Hirakawa, 2008).

### 3. Material and methods

The present article deals with the results of research and subsequent analysis. It aims to contribute to the knowledge and comprehension of the behaviour of payment card users with a special focus on the aspect of their security. The article analyses the opinions and attitudes of respondents toward the questions dealing with the security of payment systems and their behaviour when using payment cards. The analysis is carried out from the aspect of gender, age and education of respondents by using multidimensional statistical methods, namely factor analysis and analysis of dispersion. The research as well as the selection of representative sample were carried out as follows:

Time horizon of the survey: 20.02.2018 – 20.07.2018

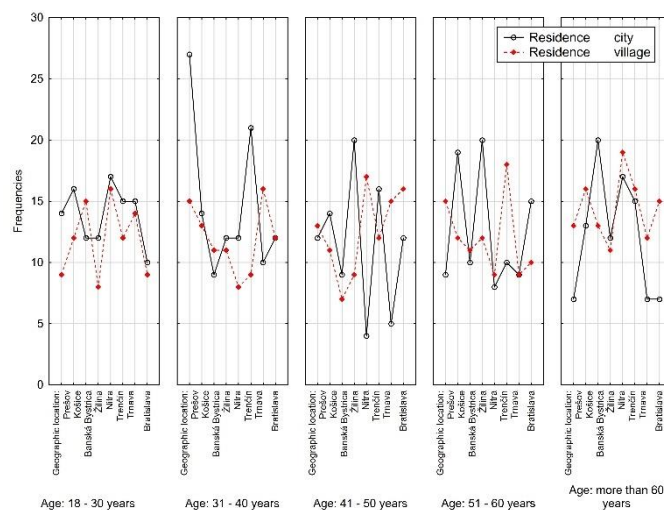
Representative sample: 1,012 respondents

Number of questionnaires issued: 4,700

Number of (completed) questionnaires collected: 3,288

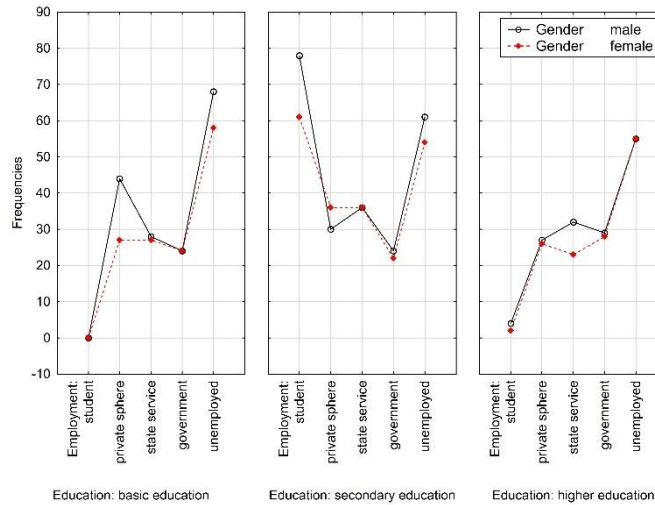
The representative sample containing 1,012 respondents was selected by random number generator from fully completed questionnaires (3,288) in such a way that it would represent the population of Slovakia over 18 years of age from the aspect of their education, size of municipality and region they live in, and occupation.

The analyzed set is represented in five age categories in ranges 18-30 years, 31-40 years, 41-50 years, 51-60 years and over 60 years. These categories are composed of 206, 212, 192, 196 and 213 respondents, respectively, which represents 2.22%, 20.80%, 18.84%, 19.23%, and 20.90% of the analyzed set, respectively. The research was conducted on 540 men (52.99%) and 479 women (47.01%). Geographically, the respondents were from the regions of Prešov, Košice, Banská Bystrica, Žilina, Nitra, Trenčín, Trnava and Bratislava in amounts 134 (13.15%), 140 (13.74%), 117 (11.48%), 127 (12.46%), 127 (12.46%), 144 (14.13%), 112 (10.99%) and 118 (11.58%), respectively. The statistical set was composed of respondents with primary (n=300; 29.44%), secondary (n=438; 42.98%) and university education (n=281; 27.58%). The analysed sample is composed of respondents living in towns (n=518; 50.83%) and villages (n=501; 49.17%). The structure of respondents can be seen in Figures 1 – 4.

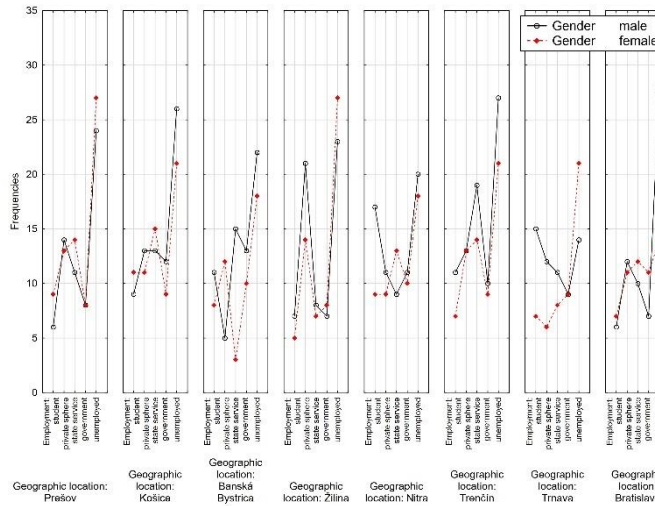


**Figure 1.** Structure of representative sample per residence, age and geographic region

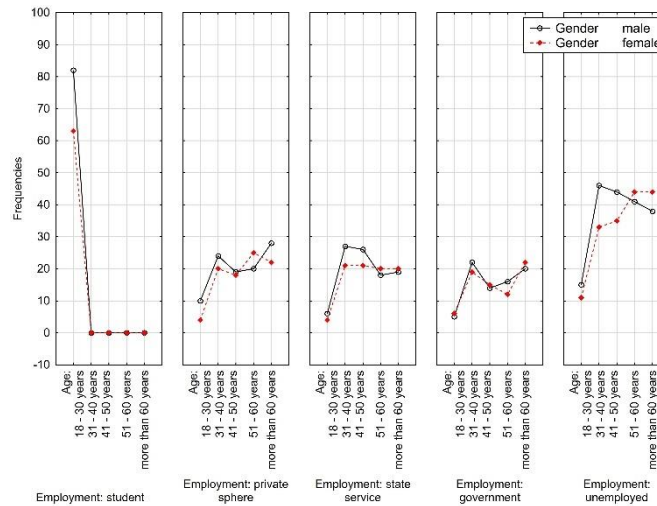
Source: Own study



**Figure 2.** Structure of representative sample per education, gender and employment  
Source: Own study



**Figure 3.** Structure of representative sample per geographic region, gender and employment  
Source: Own study



**Figure 4.** Structure of representative sample per employment, gender and age  
Source: Own study

#### 4. Results

The analysis of the behaviour of respondents when making a payment and their opinions on their security was based on answers to questions as follows:

- Q1 – Do you carry your payment card PIN code along with your payment card?
- Q2 – Have you ever changed your payment card PIN code?
- Q3 – Have you altered your payment card PIN code in a way that it would encode your date of birth?
- Q4 – Do you consider ATMs located at banks' premises safer for withdrawing your cash?
- Q5 – Do you have trust in the security of payment systems?
- Q6 – Do personal data represent information that needs to be most importantly protected?
- Q7 – Do you rely on the security measures of your bank in payment cards?
- Q8 – Are you sure that your bank takes proper care of your money?
- Q9 – Do you have any experience with a hacking attack or bank fraud?
- Q10 – Do you think that security measures taken to protect payment card data are continuously getting better?
- Q12 - How confident are you in the security of payment systems?
- Q13 – Do you think that the payment system carries elements of high security risks?
- Q18 – Does the enhanced security of new payment methods outweigh the cost of their implementation?
- Q19 – Does the enhanced customer convenience of new payment methods outweigh the cost of their implementation?
- Q20 - Why is it more challenging to secure payment card information?
- Q22 - How confident are you that customers can protect themselves when their personal information is lost or stolen?



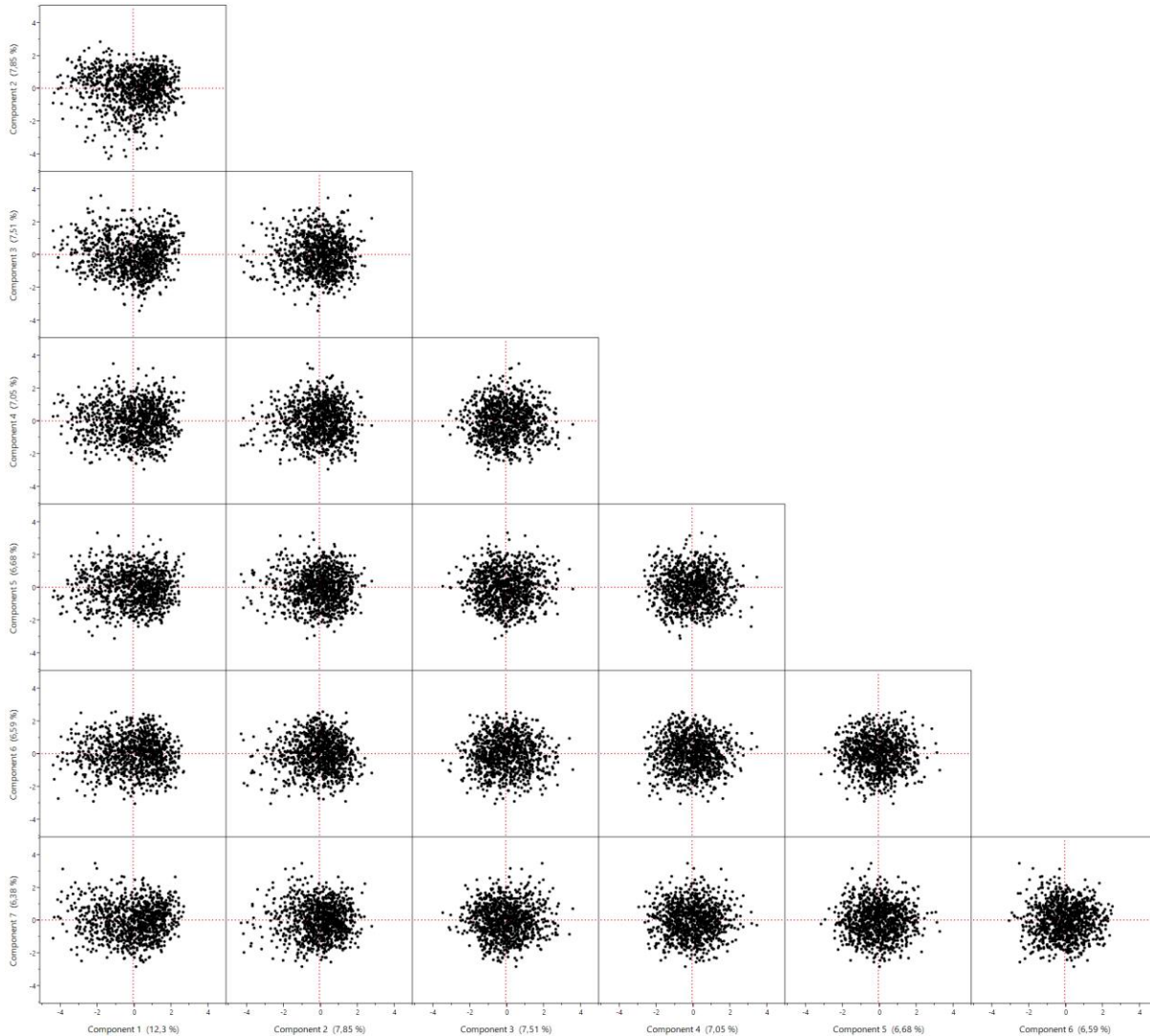
The reliability of the research tool was judged by using the Cronbach's alfa coefficient. Its value was 0.81694. Based on the latter value, it is possible to state that it is not necessary to increase the value by removing any of variables. As the Cronbach alfa exceeds the value of 0.7, we can state that the research tool is reliable, and we can safely process the data.

The method is foremostly aimed at simplifying the description of group with mutual linear dependent signs, i.e. decomposing the source data matrix into structural and noise matrices. Each of main components represents a linear combination of original signs. Main components are ordered in line with their importance, i.e. with the decreasing dispersion (Tab. 1). This implies that a major portion of information on variability of original data is concentrated in the first main component and just as much information is concentrated in the last main component.

**Table 1.** Table of original values in the source matrix of researched set

Value number	Eigenvalues of correlation matrix, and related statistics			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	1,971471	12,32169	1,97147	12,3217
2	1,255233	7,84521	3,22670	20,1669
3	1,202084	7,51302	4,42879	27,6799
4	1,128291	7,05182	5,55708	34,7317
5	1,069369	6,68356	6,62645	41,4153
6	1,054192	6,58870	7,68064	48,0040
7	1,020088	6,37555	8,70073	54,3795
8	0,971202	6,07001	9,67193	60,4496
9	0,932597	5,82873	10,60453	66,2783
10	0,858880	5,36800	11,46341	71,6463
11	0,838353	5,23971	12,30176	76,8860
12	0,827242	5,17026	13,12900	82,0563
13	0,806948	5,04343	13,93595	87,0997
14	0,772271	4,82669	14,70822	91,9264
15	0,706586	4,41616	15,41481	96,3425
16	0,585192	3,65745	16,00000	100,0000

The table of original values in source data matrix (Tab. 1) shows that the concentrations of first, second, third, fourth, fifth, sixths and seventh main components are 12.32169 %, 7.84521 %, 7.51302 %, 7.05182 %, 6.68356 %, 6.5887 %, and 6.37555 % of variability of the original data, respectively. These seven main components, whose own number is larger than 1, concentrate within themselves 54.3795 % of variability of original data of the researched set. The diagram of the dispersion measures (Fig. 5) shows that the first main component divides the responses by vertical axis into two clusters, while at negative values of the component score of the first main component, the responses to 16 of posed questions (Q1 - Q10, Q12, Q13, Q18 – Q20 and Q22) are homogenous. As opposed to the latter, at positive values of component score of the first main component, the responses are more heterogenous. In combinations of second, third, fourth, fifth, sixth and seventh main components, the data are concentrated around the centre of the coordinate system and yield a homogenous structure in all directions.



**Figure 5.** Dispersion diagram of component score

*Source: Own study*

The appropriate use of factor analysis is tested by Kaiser-Mayer-Olkin (KMO) statistics and Bartlett's test of sphericity. KMO statistics represents an index which serves for comparing the size of experimental correlation coefficients against the size of partial correlation coefficients. When the sum of squares of partial correlation coefficients between all pairs of signs is small in comparison to the sum of squares of pair correlation coefficients, the measure of KMO statistics approaches the value of 1. Low values of KMO statistics indicate that the factor analysis of original signs would not be a good approach because the correlation between the pairs of signs cannot be explained by means of the rest of signs. In accord with the value of Keiser-Mayer-Olkin statistics (0.642) and definition by Kaiser, it is possible to state that based on the used research tool, the measure of correlation is good and the choice of factor analysis for security of payment system is justified. Bartlett's test of sphericity represents a statistical test of correlation between original signs. It tests the null statistic hypothesis  $H_0$ , namely whether "the correlation between the signs does not exist", i.e. whether the correlation matrix is a unit matrix. The achieved level of significance of Bartlett's test of sphericity  $p = 0.000$  is lower than the level of significance chosen by us ( $\alpha = 5\%$ ). Thus, we can reject the null hypothesis that the realization of the selected correlation matrix with 16

considered variables is a unit matrix. Hence, to start off, we can state that the factor analysis is appropriate for the data dealing with security of payment system.

**Table 2.** Assumptions for the use of factor analysis (KMO statistics, Bartlett's test)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,642
Bartlett's Test of Sphericity	Approx. Chi-Square	629,915
	df	120
	Sig.	0,000

Source: Own study

The first step to the interpretation of results of factor analysis is to analyse the factor matrix (Tab. 3) which serves for gaining the initial number of factors. The factor matrix contains factor loading for each sign, while in each factor, it represents the best linear combination of original signs while including the highest possible number of variability of signs. The first factor is always the most important because it represents the best linear relation found in original signs. The second factor represents the second best linear relation of original data, however it is restricted by a condition that it has to be orthogonal to the first factor. The factor loading explains the role of each original sign in defining the common factor. It is, in fact, a correlation coefficient between every original sign and factor.

**Table 3.** Factor loading

Variable	Factor Loading (Varimax normalized) Extraction: Principal components						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Q1	0,667027	-0,056201	-0,009635	-0,057215	-0,047914	0,043137	-0,028946
Q2	-0,702289	-0,104631	0,149141	0,124769	-0,036834	0,127380	-0,138716
Q3	0,667834	0,008599	-0,008697	0,068546	0,022302	-0,218077	0,061900
Q4	0,030219	0,678758	-0,245063	0,044069	-0,098954	0,045068	0,133751
Q5	0,019901	-0,140903	0,650951	-0,000812	-0,066915	0,115440	0,296767
Q6	0,049937	-0,040089	0,062699	0,054951	0,009874	0,030645	0,783608
Q7	-0,014691	-0,126738	-0,064008	-0,134143	-0,056402	-0,732862	-0,095482
Q8	0,217457	0,031563	-0,055021	0,084674	0,078457	-0,654224	0,092631
Q9	-0,170928	0,049245	-0,095052	0,580158	0,203906	-0,203738	0,052174
Q10	-0,483641	0,224774	0,010966	-0,129255	-0,019166	-0,117729	0,352577
Q12	-0,202965	0,096779	0,555906	-0,202640	0,115733	0,055215	-0,145093
Q13	-0,062923	0,535860	0,004331	-0,038624	0,076363	0,080119	-0,338568
Q18	-0,031518	0,614785	0,422922	0,040299	0,008766	-0,002696	0,019843
Q19	0,055803	-0,088242	0,361737	0,298743	-0,592838	-0,237350	-0,194491
Q20	0,048449	-0,076490	0,168337	0,176893	0,804773	-0,122083	-0,100801
Q22	0,076839	0,000956	-0,051205	0,730203	-0,096729	0,236042	0,006834
Expl.Var	1,756082	1,254472	1,176141	1,104870	1,097575	1,238837	1,072751
Prp.Totl	0,109755	0,078404	0,073509	0,069054	0,068598	0,077427	0,067047

Source: Own study

The Table 3 makes it obvious that the first factor significantly correlates with components of research tool, namely with Q1 (Do you carry your payment card PIN code along with your payment card?), Q2 (Have you ever changed your payment card PIN code?), and Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth?). The values of factor loading reach the values of 60.7027 % and 66.7834 at components Q1 and Q3, respectively. The positive sign of factor loading reflects the indirect proportion, i.e. the evaluation of responses decreases on Likert scale with an increase in the number of respondents. Thus, in frame of the scale value, the responses stating “certainly not” or “no” are chosen. The factor loading of Q2 component of the research tool reaches the value of -70.2289. As it implies further from the analysis of Table 3, 44.4925 % of variability of Q1 component (“Do you carry your payment card PIN code along with your payment card”), 49,321 % of variability of component Q2 (“Have you ever changed your payment card PIN code?”) and 44,6002 % of variability of component Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth?”) are explained by the first mutual factor. The second mutual factor correlates with the component Q4 (Do you consider ATMs located at banks’ premises safer for withdrawing your cash?”), Q13 (“Do you think that the payment system carries elements of high security risks?”) and Q18 (“Does the enhanced security of new payment methods outweigh the cost of their implementation?”) with the value of factor loading of 67.8758 % at component Q4, 53.586 % at component Q13, and 61.4785 % at component Q18. This implies that 46.0712 % of variability of component Q4, 28.7146 % of component Q13, and 37.7961% of variability of component Q18 are explained by the second mutual factor. The third mutual factor significantly correlates with the components Q5 (“Do you have trust in the security of payment systems?”) and Q12 (“How confident are you in the security of payment systems?”) with values of factor loading of 65.0954 % and 55.5906 %. From Table 3, it further implies that the variability values of 42.3737 % and 30.9031 % of Q5 and Q12 components, respectively, are explained by third mutual factor.

The fourth mutual factor correlates with components Q9 (“Do you have any experience with a hacking attack or bank fraud?”) and Q22 (“How confident are you that customers can protect themselves when their personal information is lost or stolen?”) with values of factor loading of 58.0158 % at Q9 component and 3.0203 % at Q22 component, which represents the values of 33.6583 % and 53.3196 % of variability of these components explained by the fourth mutual factor. The fifth mutual factor correlates with components Q19 (“Does the enhanced customer convenience of new payment methods outweigh the cost of implementation?”) and Q20 (“Why is it more challenging to secure payment card information?”) with factor loading values of -59.284 % and 80.4773 %, which represent the variability values explained by fifth mutual factor, namely those of 35.1457 % and 64.766 % of Q19 and Q20 components, respectively. The sixth mutual factor correlates with components Q7 (“Do you rely on the security measures of your bank in payment cards?”) and Q8 (“Are you sure that your bank takes proper care of your money?”). The factor loading values are -59.284 % and -65.422 % for Q7 and Q8 components of research tool, respectively. Both components yield a negative degree of correlation. The last, seventh extracted factor correlates with Q6 component (“Do personal data represent information that needs to be most importantly protected?”) with factor loading value of 78.3608 % which represents a variability of 61.4041 % of this component explained by seventh mutual factor. Aside from defining the basic mutual correlations, we have tested also the practical significance of factors.

Based on the facts mentioned above, the factors of the main research objective, defined as a restriction of main identifiers of the security of payment systems and secure behavior of respondents, can be postulated as follows:

- Factor 1 – PIN code
- Factor 2 – Awareness of security risks,
- Factor 3 – Knowledge of security elements,
- Factor 4 – Personal experience with fraud,
- Factor 5 – Enhancement of security of payment systems,

- Factor 6 – Trust in banks
- Factor 7 – Need of protecting the security elements.

The factor analysis focuses foremostly on parameters of the factor model. It may require estimations of mutual factors, which is referred to as factor score. The values of mutual factors in  $n$  selected observed objects or observations are not only a useful tool for diagnosing the data, but possibly also an important entry into further analyses. The factor score is not an estimation of parameters in common sense because it involves estimations of values of non-observed quantities. The estimations of factor score for a given object can be imagined as its coordinates in R-dimensional space.

**Table 4.** Coefficients of factor score

Variable	Factor Score Coefficients Rotation: Varimax normalized Extraction: Principal components						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Q1	0,403974	-0,013833	0,052359	-0,061879	-0,025194	0,116074	-0,046696
Q2	-0,398755	-0,128143	0,058275	0,125695	-0,041488	0,025549	-0,119585
Q3	0,375695	0,057193	0,070984	0,054799	0,030542	-0,108248	0,042342
Q4	0,027875	0,548057	-0,210160	0,038413	-0,103424	0,005812	0,141195
Q5	0,072687	-0,104559	0,553875	0,010329	-0,027592	0,069398	0,255593
Q6	0,015465	-0,015685	0,039837	0,040412	0,018702	0,018291	0,727772
Q7	-0,102795	-0,061977	-0,027040	-0,115261	-0,078224	-0,606415	-0,076729
Q8	0,050911	0,078406	0,009138	0,079014	0,053975	-0,524822	0,092201
Q9	-0,137283	0,047838	-0,066609	0,528113	0,171820	-0,190067	0,054055
Q10	-0,301059	0,168865	-0,042920	-0,110880	-0,033603	-0,173483	0,350339
Q12	-0,045912	0,066089	0,467854	-0,163334	0,123199	-0,001508	-0,140003
Q13	0,011815	0,417752	0,011906	-0,024544	0,064394	0,035366	-0,305297
Q18	0,054389	0,502483	0,376989	0,055539	0,018987	-0,064813	0,019703
Q19	0,023964	-0,043568	0,321691	0,283831	-0,534320	-0,225482	-0,197507
Q20	0,049374	-0,056303	0,197145	0,166662	0,740724	-0,074662	-0,096994
Q22	0,055867	-0,000993	-0,032630	0,656919	-0,080331	0,198365	-0,007713

Source: Own study

In line with the defined goals of research, the subsequent section deals with the analysis of respondents' opinions or attitudes represented by factor score in relation to extracted identifiers, factors of payment system security by means of Fisher's ANOVA. Within the analysis, we shall be considering only the impact of significant independent variables or that of their interactions on the value of respective factor at the selected level of significance  $\alpha = 0.05$ .

ANOVA is an acronym standing for analysis of variance. ANOVA serves for comparing various sources or characteristics of various classes. These sources are referred to as factors and can contain several various levels. The goal is to decide whether the mean value of the measured quantity differs for various factors. This is demonstrated by testing the hypothesis on the impact of factor on the mean value. In this case, the zero hypothesis states that the mean values of tested groups do not differ significantly.

**Table 5.** ANOVA for Factor 1 (Payment card PIN code)

Effect	Univariate Tests of Significance for Factor n.1 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0,0739	1	0,07385	0,10685	0,743829
Age	70,5132	4	17,62831	25,50408	0,000000
Gender	0,0455	1	0,04549	0,06581	0,797591
Education	130,3322	2	65,16608	94,28025	0,000000
Age*Gender	2,6284	4	0,65709	0,95066	0,433863
Age*Education	28,9456	8	3,61820	5,23470	0,000002
Gender*Education	0,7795	2	0,38977	0,56391	0,569160
Age*Gender*Education	4,6 555	8	0,58194	0,84193	0,565697
Error	683,5923	989	0,69120		

Source: Own study

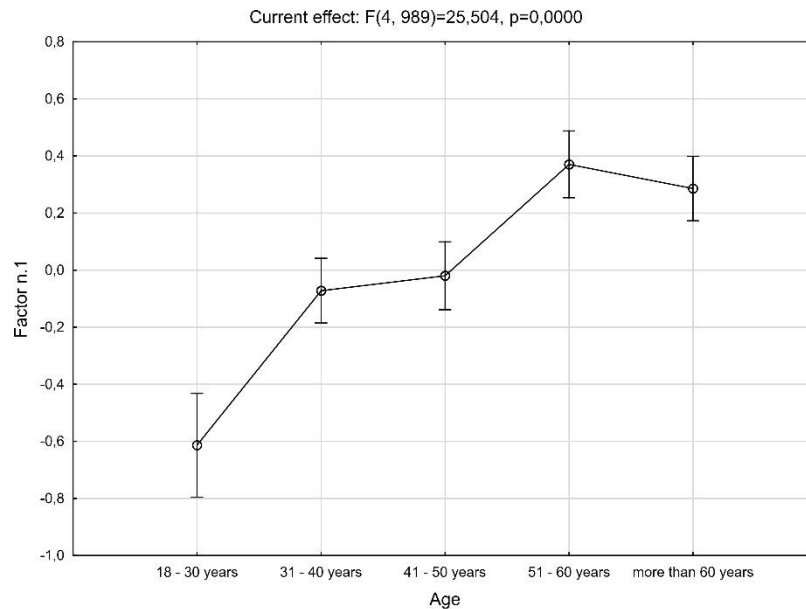
The Table 5 shows that a change in Factor 1 (Payment card PIN code) expressed by factor score is significantly influenced by the age of respondents, their education, and mutual interaction of age and education, namely at the level of significance of  $\alpha = 5\%$ . When the factor score is, as a result of factor analysis, considered a measure of consent, attitude or importance for the respondent, while a positive or negative number represents a positive perception and importance or negative attitude and unimportance of the given factor for respondents, respectively, then we can state that the average value of factor score for the category of 18 – 30 years of age represents a value of -0.651576.

This can be interpreted as unimportance of the given factor for the observed age category of respondents.

The category of 31-40 years of age reaches the factor score of -0.062128. Hence, also for the latter age category, this factor is unimportant while achieving a lower value when expressed in absolute terms.

The age category of 41-50 years achieves the average value of -0.10293 of factor score, which indicates an indifferent attitude of respondents to the problem of using payment card PIN code. A change in value, and therefore increase in importance represented by positive values of average factor score can be found in categories of 51-60 and over 60 years of age, where it achieves values of +0.38045 and +0.350828, respectively. The average values of factor score for individual age categories for the extracted factor referred to as payment card PIN code are graphically depicted in Figure 6.

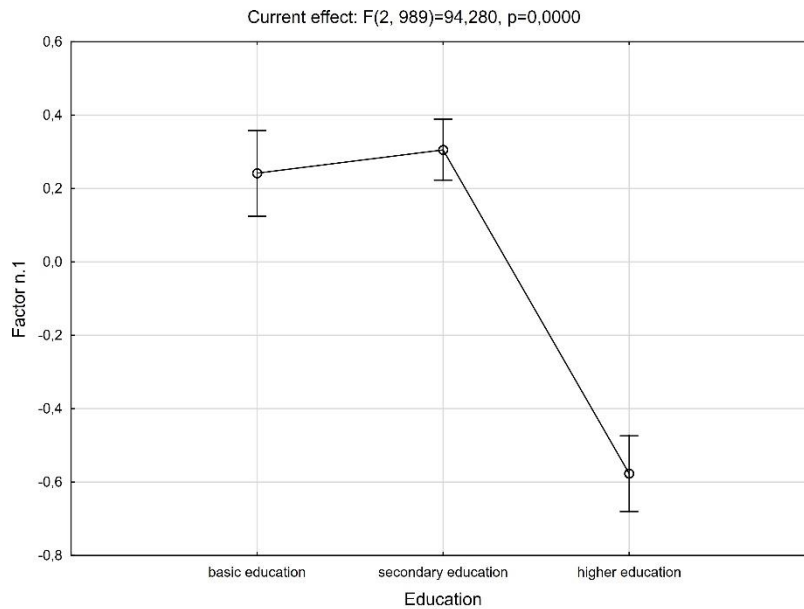




**Figure 6.** Dependence of average value of factor score on age category of respondents

*Source:* Own study

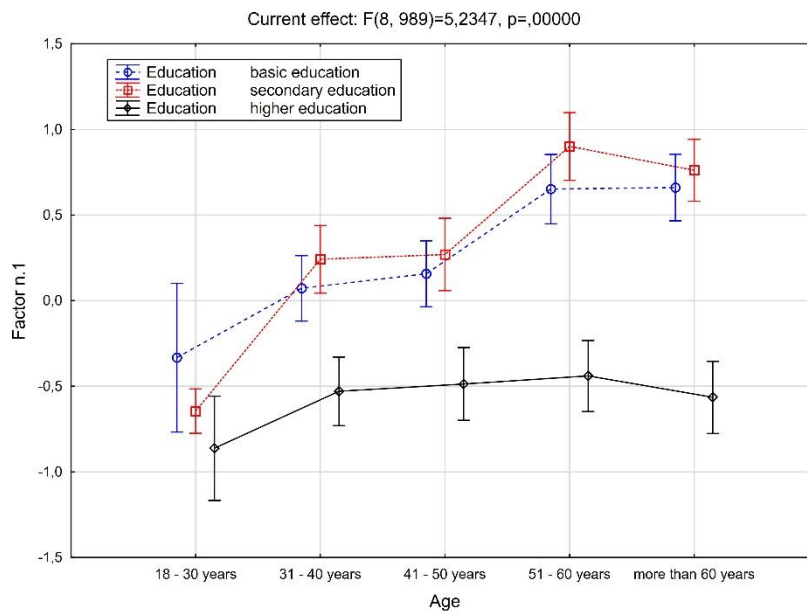
The second factor significantly influencing the value of achieved factor score for the first extracted factor is that relating to education of respondents. This implies from Table 5 based on the achieved levels of significance ( $p=0.000000$ ). The average value of achieved factor score for respondents with primary education is 0.338203, which indicates a positive perception of the problem of payment card PIN code as a security feature and its importance for the latter category of respondents. Equally positive values of factor score are also those achieved for the group of respondents with secondary education, in whom, however, the average value is 0.117786. The negative values of factor score for respondents with university education achieve the average of -0.544667. The average values of factor score for individual education categories for the second extracted factor (referred to as Payment card PIN code) are graphically depicted in Figure 7.



**Figure 7.** Dependence of average value of factor score for Factor 1 on education of respondents

*Source: Own study*

The Table 5 further shows that based on the level of significance ( $p=0.000002$ ), the average value of achieved factor score for the first extracted factor referred to as Payment card PIN code is significantly influenced also by the interaction of age and education of respondents. This is illustrated in Figure 8.



**Figure 8.** Dependence of average value of factor score for Factor 1 on the interaction of age and education of respondents

*Source: Own study*

The Figure 8 shows that the increase in age in respondents with primary education brings about also an increase in the average value of factor score, however the increase in age in categories over 51 years of age ceases to be reflected in the average value. A similar trend in average value of factor score can be seen also in respondents with secondary education, although the category older than 60 years of age yields a decrease. The basic statistical characteristics of values of factor score for the interaction of age and education are given in Table 6.

**Table 6.** Statistical characteristic of the achieved factor score for Factor 1 and interaction of age and education of respondents

Effect	Level of Factor	Level of Factor	N	Factor n.1 Mean	Factor n.1 Std.Dev.	Factor n.1 Std.Err	Factor n.1 -95,00%	Factor n.1 +95,00%
Total			1019	0,000000	1,000000	0,031327	-0,06147	0,061472
Age*Education	18 - 30 years	basic education	17	-0,336385	0,938893	0,227715	-0,81912	0,146349
Age*Education	18 - 30 years	secondary education	160	-0,646981	0,527793	0,041726	-0,72939	-0,564573
Age*Education	18 - 30 years	higher education	29	-0,861699	0,337073	0,062593	-0,98991	-0,733483
Age*Education	31 - 40 years	basic education	75	0,089651	0,891998	0,102999	-0,11558	0,294881
Age*Education	31 - 40 years	secondary education	68	0,241486	1,054671	0,127898	-0,01380	0,496771
Age*Education	31 - 40 years	higher education	69	-0,526318	0,468148	0,056358	-0,63878	-0,413856
Age*Education	41 - 50 years	basic education	72	0,159906	0,953586	0,112381	-0,06418	0,383988
Age*Education	41 - 50 years	secondary education	60	0,262373	1,093952	0,141229	-0,02023	0,544970
Age*Education	41 - 50 years	higher education	60	-0,487197	0,586230	0,075682	-0,63864	-0,335758
Age*Education	51 - 60 years	basic education	65	0,649781	0,904951	0,112245	0,42555	0,874017
Age*Education	51 - 60 years	secondary education	68	0,894503	1,111443	0,134782	0,62548	1,163529
Age*Education	51 - 60 years	higher education	63	-0,451054	0,483099	0,060865	-0,57272	-0,329387
Age*Education	more than 60 years	basic education	71	0,657839	0,999955	0,118673	0,42115	0,894525
Age*Education	more than 60 years	secondary education	82	0,757533	1,066848	0,117814	0,52312	0,991946
Age*Education	more than 60 years	higher education	60	-0,568299	0,498832	0,064399	-0,69716	-0,439437

Source: Own study

The initial results presented in Table 5 do not sufficiently answer the basic question as to which age and education groups of respondents differ from each other in relation to the value of achieved factor score. A more profound understanding of the differences between individual significant factors influencing the change in average value of factor score for the first extracted factor can be aided with the use of Scheffe's test.

**Table 7.** The result of Scheffe's test per age category and value of factor score for Factor 1

Cell No.	Scheffe test; variable Factor n.1 Probabilities for Post Hoc Tests Error: Between MS = ,69120, df = 989,00					
	Age	{1} -,6516	{2} -,0621	{3} -,0103	{4} ,38084	{5} ,35083
1	18 - 30 years		0,000000	0,000000	0,000000	0,000000
2	31 - 40 years	0,000000		0,983129	0,000010	0,000033
3	41 - 50 years	0,000000	0,983129		0,000281	0,000826
4	51 - 60 years	0,000000	0,000010	0,000281		0,997879
5	more than 60 years	0,000000	0,000033	0,000826	0,997879	

Source: Own study

Table 7 shows that for the level of significance of  $\alpha=5\%$ , there exists a significant difference in the average value of the achieved factor score between age category 18-30 years of age and all other observed age categories, between age categories 31-40 and 51-60 years of age and between those of 31-40 and over 60 years of age. Then we can find a significant difference in the average value of factor score between age categories 41-50 and 51-60 years of age and at the same time also in relation to the category over 60 years of age. On the other hand, statistically insignificant differences can be found between age categories 31-40 and 41-50 years of age and those over 60 and 61-60 years of age.

**Table 8.** The result of Scheffe's test per education category and value of factor score for Factor 1

Cell No.	Scheffe test; variable Factor n.1 Probabilities for Post Hoc Tests Error: Between MS = ,69120, df = 989,00			
	Education	{1} ,33820	{2} ,11779	{3} ,5447
1	basic education		0,001993	0,00
2	secondary education	0,001993		0,00
3	higher education	0,000000	0,000000	

Source: Own study

The results of Scheffe's test (Tab. 8) indicate that there is a significant mutual difference between the average value of achieved factor score between individual groups of education of respondents.

The present analysis clearly shows that the attitude of respondents to the problem of basic rules of using the payment card PIN code (Q1: Do you carry your payment card PIN code along with your payment card?; Q2: Have you ever changed your payment card PIN code?; Q3: Have you altered your payment card PIN code in a way that it would encode your date of birth?) is influenced foremostly by age, education and mutual interaction of age and education of respondents. The analyzed data have shown that 94.17 % of respondents at 18-30 years of age definitely do not carry the payment card PIN code along with their payment card, while in category over 60 years of age, the percentage is 64.32 %. On the other hand, the payment card PIN code is carried along with the payment card only in 5.8 % of respondents at 18-30 years of age, while in the category over 60 years of age, the total percentage is 33.8 %. As to this first question, there is a similar finding also from the aspect of education of respondents. While in category of respondents with primary education, the payment card PIN is carried along with the payment card in 30.3 %, in those with secondary education, the percentage is 26.7 %, and in those with university education, the percentage is as low as 5.3. As to the second question of the research tool (Q2: Have you ever changed your payment card PIN code?), we are coming to similar conclusions as in the precedent component. As many as 93.20 % of respondents in category of 18-30 years of age have changed their payment card PIN code, while in the same category on the other side of Likert's scale, the proportion is 4.9 %. On the other hand, a certain positive feature in conceiving the basic security rules can be found also in the category over 60 years of age, which is considered to be a risk category from the aspect of security of payment systems. In the latter category, as many as 65.73 % of respondents have changed their payment card PIN code. Nevertheless, as many as 30.00 % of respondents of the latter age category have not changed their payment card PIN code. The second question was answered positively and thus the payment card PIN code was changed by 70.3 %, 71.9 % and 93.6 % of respondents with primary, secondary and university education, respectively. The last component of the first extracted factor, namely Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth?) represents most possibly the weakest point in payment card users who are often unaware of the risk it poses to them. As few as 4.4 % of respondents at 19-30 years of age have a date of birth encoded in their PIN code, while in the category over 60 years, their proportion is 38.50 %. The present analysis leads to a conclusion that the level of information on risks associated with the use of payment card PIN code is insufficient

especially in older people and those with primary information. Naturally, a more profound analysis of further extracted factors would be needed to arrive at comprehensive understanding of the habits exposing the users of payment cards to risks associated with using the PIN code. Unfortunately, the scope of the present analysis is not that wide. However, the authors intend to analyse further factors with the use of multidimensional statistical methods.

## Conclusions

The present analysis clearly shows that the attitude of respondents to the problem of basic rules of using the payment card PIN code (Q1: Do you carry your payment card PIN code along with your payment card?; Q2: Have you ever changed your payment card PIN code?; Q3: Have you altered your payment card PIN code in a way that it would encode your date of birth?) is influenced foremostly by age, education and mutual interaction of age and education of respondents. The analyzed data have shown that 94.17 % of respondents at 18-30 years of age definitely do not carry the payment card PIN code along with their payment card, while in category over 60 years of age, the percentage is 64.32 %. On the other hand, the payment card PIN code is carried along with the payment card only in 5.8 % of respondents at 18-30 years of age, while in the category over 60 years of age, the total percentage is 33.8 %. As to this first question, there is a similar finding also from the aspect of education of respondents. While in category of respondents with primary education, the payment card PIN is carried along with the payment card in 30.3 %, in those with secondary education, the percentage is 26.7 %, and in those with university education, the percentage is as low as 5.3. As to the second question of the research tool (Q2: Have you ever changed your payment card PIN code?), we are coming to similar conclusions as in the precedent component. As many as 93.20 % of respondents in category of 18-30 years of age have changed their payment card PIN code, while in the same category on the other side of Likert's scale, the proportion is 4.9 %. On the other hand, a certain positive feature in conceiving the basic security rules can be found also in the category over 60 years of age, which is considered to be a risk category from the aspect of security of payment systems. In the latter category, as many as 65.73 % of respondents have changed their payment card PIN code. Nevertheless, as many as 30.00 % of respondents of the latter age category have not changed their payment card PIN code. The second question was answered positively and thus the payment card PIN code was changed by 70.3 %, 71.9 % and 93.6 % of respondents with primary, secondary and university education, respectively. The last component of the first extracted factor, namely Q3 (Have you altered your payment card PIN code in a way that it would encode your date of birth?) represents most possibly the weakest point in payment card users who are often unaware of the risk it poses to them. As few as 4.4 % of respondents at 19-30 years of age have a date of birth encoded in their PIN code, while in the category over 60 years, their proportion is 38.50 %. The present analysis leads to a conclusion that the level of information on risks associated with the use of payment card PIN code is insufficient especially in older people and those with primary information. Naturally, a more profound analysis of further extracted factors would be needed to arrive at comprehensive understanding of the habits exposing the users of payment cards to risks associated with using the PIN code. Unfortunately, the scope of the present analysis is not that wide. However, the authors intend to analyse further factors with the use of multidimensional statistical methods.

There are different parts of the payment process that need to be secure. Firstly, the account access needs to be limited to authorized users only. Traditionally, authorized users can be identified by government-issued identification, passwords, signatures, and other information about a person such as her favorite sports team, name of her first-grade teacher, or that of the first street that she lived on. To some extent, such information can be accessed by unauthorized users. Biometrics can be also the means of authenticating. While biometrics has long been part of science fiction and spy movies, only recently, consumers are able to use their fingerprints to access sensitive data and approve payments. While still in the early stages of adoption, fingerprint authentication is likely to expand in the coming years. Secondly, the exchange of live account credentials that are used to make purchases is extremely high. Payment card numbers along with demand deposit numbers are commonly asked for to make

purchases. Once these numbers are in the possession of unauthorized users, the likelihood of fraud increases. Thirdly, fraud associated with making payments when accounts do not have sufficient funds can be eliminated by buyers instructing their financial institutions to make payment. Given today's technology and online connectivity, payment instruments such as checks where real-time account and sufficient balance verification are not generally available should be eliminated for large purchases or transfers. Some countries have had great success in eliminating checks. Fourthly, payment providers often take on additional liability to encourage usage which may have the unintended effect of reducing incentives for cardholders to make prudent decisions regarding keeping live payment credentials secure. However, significant fraud continues to occur and these costs may be reduced if consumers were held accountable for not adequately safekeeping their payment credentials (Chakravorti, S. 2016).

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### References

- Athanasoulis, S., Shiller, R., & Van Wincoop, E. (1999). Macro Markets and Financial Security. *FRBNY Economic policy review*, 5(1), 21-39. Retrieved from <https://www.newyorkfed.org/medialibrary/media/research/epr/99v05n1/9904atha.pdf>
- Baldwin, A., Beres, Y., Duggan, G. B., Mont, M. C., Johnson, H., Middup, C., & Shiu, S. (2011). *Economic Methods and Decision Making by Security Professionals*. Retrieved from <https://researchportal.bath.ac.uk/en/publications/economic-methods-and-decision-making-by-security-professionals>
- Bányász, P. (2018) The emergence of cyber security in the scientific community, *Military Engineer (XIII) III 362 XIII year 3, number - Conference: Tudomány kapujában September 2018*, <https://doi.org/10.13140/RG.2.2.28913.33124>
- Delaquil, P., Goldstein, G., Nelson, H., Peterson, T., Roe, S., Rose, A., Wei, D., & Wennberg, J. (2012). *Developing and Assessing Economic, Energy, and Climate Security and Investment Options for the US*. (2012 International Energy Workshop Paper). Center for Climate Strategies. Retrieved from [https://www.decisionwaregroup.com/assets/ccs\\_strategic-investment-project\\_report.pdf](https://www.decisionwaregroup.com/assets/ccs_strategic-investment-project_report.pdf)
- Dobrovič, J., Gombár, M., & Benková, E. (2017). Sustainable development activities aimed at combating tax evasion in Slovakia. *Journal of Security and Sustainability Issues*, 6(4): 761-772. [https://doi.org/10.9770/jssi.2017.6.4\(19\)](https://doi.org/10.9770/jssi.2017.6.4(19))
- Gaigaliene, A., Jurakovaite, O., & Legenzova, R. (2018). Assessment of EU banking network regionalization during post-crisis period. *Oeconomia Copernicana*, 9(4) : 655-675. <https://doi.org/10.24136/oc.2018.032>
- Hacker, J. S., Huber, G. A., Nichols, A., Rehm, P., Schlesinger, M., Valletta, R., & Craig, S. (2014). The Economic Security Index: A New Measure for Research and Policy Analysis. *Special Issue: Economic Insecurity: Challenges, Issues and Findings*, 60(S1), 5-32. <https://doi.org/10.1111/roiw.12053>
- Horecký, J. (2018). Operation and action of a trade union (in terms of Czech Republic labour law). *Central European Journal of Labour Law and Personnel Management*, 1(1) : 17 – 27 . <http://doi.org/10.33382/cejllpm.2018.01.02>
- Chakravorti, S. (2016) New Payment Technologies: Back to Basicsin Digital Transformation of Payment Media conference organized by Funcas, May 26, 2016 in Madrid, Spain. <http://doi.org/10.2139/ssrn.2781264>
- Jančíková, E., & Veselovská, S. 2018. The new Technologies and the Fight Against Money Laundering and the Terrorism Financing. In *2nd International Scientific Conference - EMAN 2018 - Economics and Management: How to Cope With Disrupted Times*, Ljubljana - Slovenia, March 22, 2018, ISBN 978-86-80194-11-0. <https://doi.org/10.31410/EMAN.2018.334>



Jančíková, E., & Pásztorová, J. (2018). Strengthened EU Rules to Tackle Money Laundering and Terrorism Financing and their Implementation in Slovak Republic. In Staničková, M., L. Melecký, E. Kovářová and K. Dvoroková (eds.). *Proceedings of the 4 th International Conference on European Integration 2018* . Ostrava: VŠB - Technical University of Ostrava, 2018, pp. 528-536. ISBN 978-80-248-4169-4. ISSN 2571-029X.

Jantoń-Drozdowska, E., & Mikołajewicz-Woźniak, A. (2017). The impact of the distributed ledger technology on the Single Euro Payments Area development. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 12(3) : 519–535. <https://doi.org/10.24136/eq.v12i3.28>

Korauš, A., Gombár, M., Kelemen, P., Backa, S. 2019a. Using quantitative methods to identify security and unusual business operations. *Entrepreneurship and Sustainability Issues*, 6(3): 1101-1012. [http://doi.org/10.9770/jesi.2019.6.3\(3\)](http://doi.org/10.9770/jesi.2019.6.3(3))

Korauš, A., Dobrovič, J., Polák, J., Kelemen, P. 2019b. Security position and detection of unusual business operations from science and research perspective. *Entrepreneurship and Sustainability Issues*, 6(3):1270-1279. [http://doi.org/10.9770/jesi.2019.6.3\(15\)](http://doi.org/10.9770/jesi.2019.6.3(15))

Kordík, M., Kurilovská, L., Intra Group Compliance Agreement as a tool to manage the risks in the daughter companies. *Entrepreneurship and Sustainability Issues*, 5(4):1008-1019, [https://doi.org/10.9770/jesi.2018.5.4\(21\)](https://doi.org/10.9770/jesi.2018.5.4(21))

Klein, J. (2009). The Politics of Economic Security: Employee Benefits and the Privatization of New Deal Liberalism. *The Journal of Policy History*, 16(1): 34-65. <https://doi.org/10.1353/jph.2004.0002>

Mamojka, M.; & Müllerová, J. (2016). New methodology for crisis management RM/RA CRAMM and its legal frame. In: Production management and engineering sciences. - Leiden: CRC Press/Balkema, 2016. pp 185-190. ISBN 978-1-138-02856-2.

Mura, L., Marchevska, M., & Dubravská, M. (2018). Slovak Retail Business Across Panel Regression Model. *Marketing and Management of Innovations*, 4, pp. 203-211. <http://doi.org/10.21272/mmi.2018.4-18>

Müllerová, J., & Mamojka, M. 2017. Legal possibilities of the rescue forces during the emergency event. In: SGEM2017 Conference Proceedings, 29 June-5 July, 17(51): 605-612. ISBN 978-619-7408-08-9/ISSN 1314-2704. <https://doi.org/10.5593/sgem2017/51/S20.079>

Novotný, J. (2015). Customer segmentation and customer relationship management. *Acta Oeconomica Universitatis Selye*, 4 (1) : 114 – 119. ISSN 1338-6581

Paulík, J., Sobeková Majková, M., Tykva, T., & Červinka, M. (2015). Application of the CSR Measuring Model in Commercial Bank in Relation to their Financial Performance. *Economics and Sociology*, 8(4): 65-81. <http://dx.doi.org/10.14254/2071-789X.2015/8-4/5>

Poliačiková, E. (2017). Perception of types of markets of customers in Slovakia. *Acta Oeconomica Universitatis Selye* 6 (1) : 129 – 136. ISSN 1338-6581

Shive, S. A., & Forster, M. M. (2017). The Revolving Door for Financial Regulators. *Review of Finance*, 21(4), 1445-1484. <https://doi.org/10.1093/rof/rfw035>

Žuřová, J., Švec, M., & Madleňák, A. (2018). Personality aspects of the employee and their exploration from the GDPR perspective. *Central European Journal of Labour Law and Personnel Management*, 1(1), 68 – 77. <http://doi.org/10.33382/cejllpm.2018.01.05>

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## FEATURES OF THE MANAGEMENT OF INTERNATIONAL PROJECTS, TAKING INTO ACCOUNT INTERCULTURAL DIFFERENCES OF THE PARTNERS

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**Abstract** This publication presents the research results of the features of cross-cultural interaction in international management. International economic relations may evolve through major joint projects based on the teamwork. The problem of management in this case is to ensure mutual trust and consensus between teams from different countries. As part of the research, the features of the development of organizations from Russia, India and China were studied. The internal specificity of the types of organizational development and leadership models within the company create prerequisites for the differentiation of communications between partners. Taking into account the revealed differences is recommended in joint planning, organizing of control over the projects execution, and creating of international working groups.

**Keywords:** Culture, cross-cultural management, international relations, cultural peculiarities, efficient cooperation, organizational development.

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**JEL Classifications:** Z13

**Additional disciplines:** psychology

### 1. Introduction

Russia-based company RC\* launched a project on natural gas liquefaction (LNG) produced from the deposits of the Barents Sea. This is an international project, as in future the products shall be delivered to the key markets of Japan, China, and India. Therefore, it is necessary to take into account the involvement of foreign partners, namely the representatives of Chinese and Indian oil companies, namely CC and IC respectively. Those companies shall provide access to local markets and technologies by participating in the capital of a joint venture.

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\* For confidentiality reasons, company names used in this paper were changed

There is a huge interest in Russian energy resources in the Asian market due to a geographical location of Russia (Shakhovskaya et al. 2018). In modern economy, every organization is seeking for different collaborations, rather than stay isolated (Muradli, Ahmadov 2019; Girdzijauskaite et al. 2019). Nowadays, the main strategy of Russian government in terms of industrial companies should focus on investment and technological policies, which will encourage the sufficient development in these areas, following by the emergence of new companies, which will become the new industrial leaders (Maslennikov, Chernitsova 2017). LNG production from Barents deposits is an ambitious international project that requires more than \$20 billion investment. Minimum payback period will make about eight years following the project launch. As a rule, the plans for the development of such projects cover production, financial, organizational, and marketing issues. However, the quality of relations between partners, who are characterized by significant cultural differences, greatly affects the success of the project under consideration. The question is how these three companies can be characterized in the terms of leadership and organization types.

**Aim of the article**

This article is aimed at analyzing cultural specificities of the partners of the oil and gas project in the context of leadership and organization types.

**Research hypothesis**

Management of major projects is a complex managed system, which effectiveness depends on the quality of decisions made with the high importance of each element of the management cycle. The overall effectiveness of management depends on the structure of the management system, the mental model and the aim of management, which is laid down in the basis of decision-making and in the actual procedures by which the solution is developed and implemented. The structure of the management system and its procedures are analytical, amenable to formalization and optimization based on the principles of rationality. Mental models, which are inherent to different national partners are cognitive and they generate heuristic solutions. Without taking into account the specifics of mental models of national partners, the management of international projects may have low efficiency. For the efficient integration of mental models into project management, it is necessary and sufficient to define their key characteristics describing differences or similarities from a management perspective. The process of preventing and resolving conflicts, connected with international relations is a multidisciplinary approach, which includes psychology, sociology and many other disciplines (Kazanský, Andrassy 2019). The authors believe that the organizational type of national companies will determine the effectiveness of procedures implementation and the predominant type of leadership will ensure consistency and efficiency of teamwork. The study of national management culture and mental model of leadership will allow to additionally optimize management decisions in international projects.

**Practical significance**

The results of this study could be used for evaluation of the management models of various participants, united in a single project. Assessment tools allow to determine the type of organization and the leadership model of any differentiated team, regardless of the sphere of economic activity. The results of an empirical study describing the specifics of Russian, Chinese and Hindu management could be applied for management optimization in the interaction process of such groups in real business. Comparison of groups according to the degree of cultural differences and adaptability allows to adjust employee behavior patterns, set target priorities and areas of interaction (Pozdniakov, Le 2016). The methodology and results of the research are both of methodological and practical value for scholars interested in problems of cross-cultural management, and teachers who teach similar disciplines.

## 2. Theoretical base of research

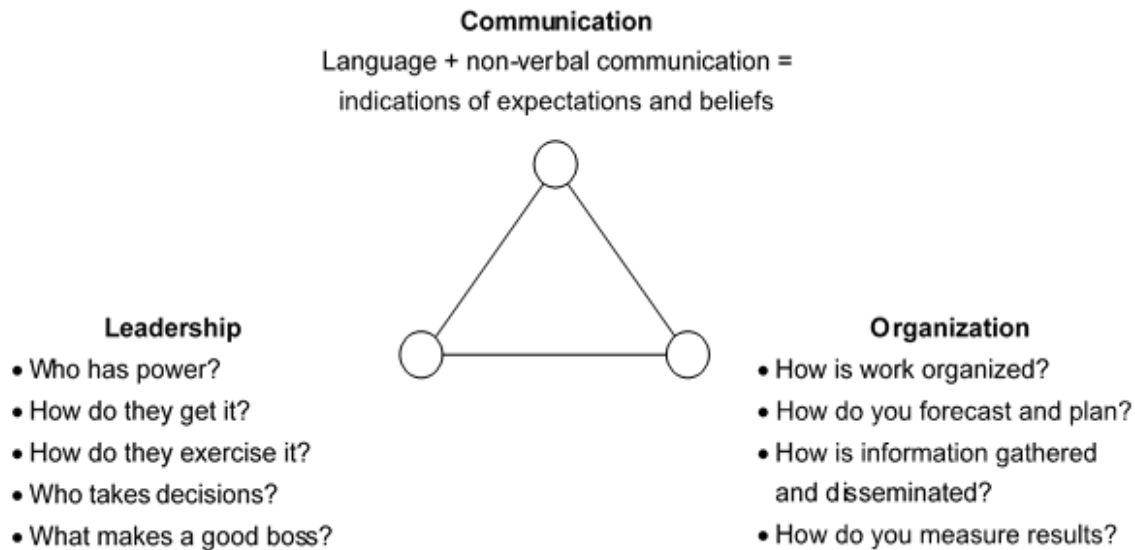
Cross-cultural management addresses a whole host of issues, such as meetings and negotiations, team working, motivation, ethical conflicts etc. (Table 1). However, each author presented in the table emphasizes three basic components that create a culture triangle, namely communication, leadership and organization (Mole 2003; Rugman et al. 2006). In fact, these problem domains are the key ones as they involve other areas mentioned earlier. For example, principles of business organization directly affect incentive system and teamwork, leadership influences interaction efficiency of team members and conflict management, while communication identifies the effectiveness of meetings and negotiations, and ethical attitude to judgments and conduct of other people. Consequently, it is very important to discover the essence of communication, leadership, and organization in the context of cross-cultural relations to understand the principles for the design of the efficient cooperation between the representatives of various cultures. The understanding of the aforementioned problem domains allows developing a research framework aimed at the elaboration of the principles of cross-cultural management for major international projects.

**Table 1.** Problem areas in cross-cultural management

Authors	Problem areas
Mole (2003)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Leadership</li> <li>• Organization</li> <li>• Meetings and negotiations</li> </ul>
Lewis (2006)	<ul style="list-style-type: none"> <li>• Leadership</li> <li>• Organization</li> <li>• Team working</li> <li>• Motivation</li> <li>• Meetings and negotiations</li> </ul>
Rugman et al. (2006)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Leadership</li> <li>• Organization</li> </ul>
Steers et al. (2010)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Leadership</li> <li>• Organization</li> <li>• Team working</li> <li>• Motivation</li> <li>• Meetings and negotiations</li> <li>• Ethical conflicts</li> </ul>
Hurn and Tomalin (2013)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Leadership</li> <li>• Team working</li> <li>• Meetings and negotiations</li> </ul>

*Source:* Mole 2003, Lewis 2006, Rugman et al. 2006, Steers et al. 2010, Hurn and Tomalin 2013

In general, communications include verbal and nonverbal signals, which reflect certain expectations and beliefs of the representatives of various cultures. Leadership involves the issues as to who and how authority is delegated within the company, what are the specificities of decision-making process, what are the characteristics peculiar to a capable leader, depending on the cultural context. At the same time, it is important to understand, how workflow is arranged at the company, including forecasting and planning activities, information gathering and dissemination, and progress measurement (Figure 1). The detailed discussion of each mentioned problem domain of cross-cultural management is provided below. As the research is underpinned by the international project, involving the representatives of China, India, and Russia, leadership, communication and organization issues can be studied in the context of the respective cultures.

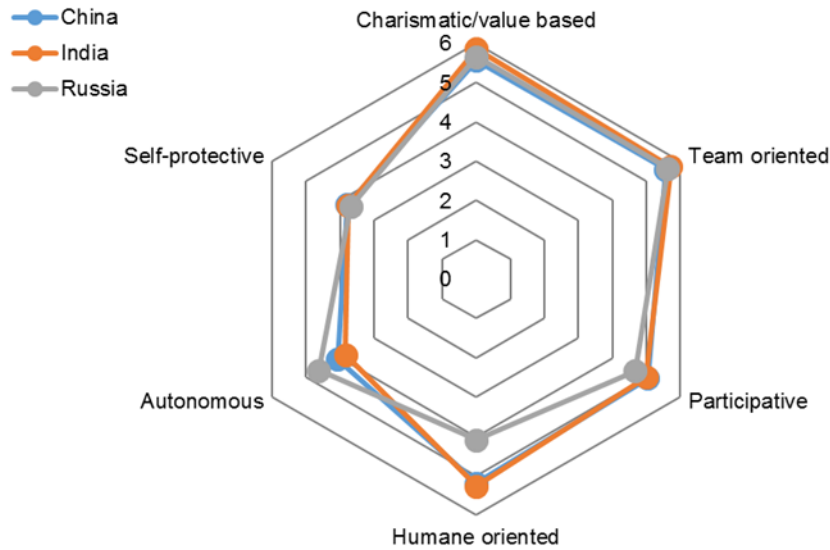


**Fig.1.** Management dimensions of culture

*Source:* Rugman et al., 2006, p.142

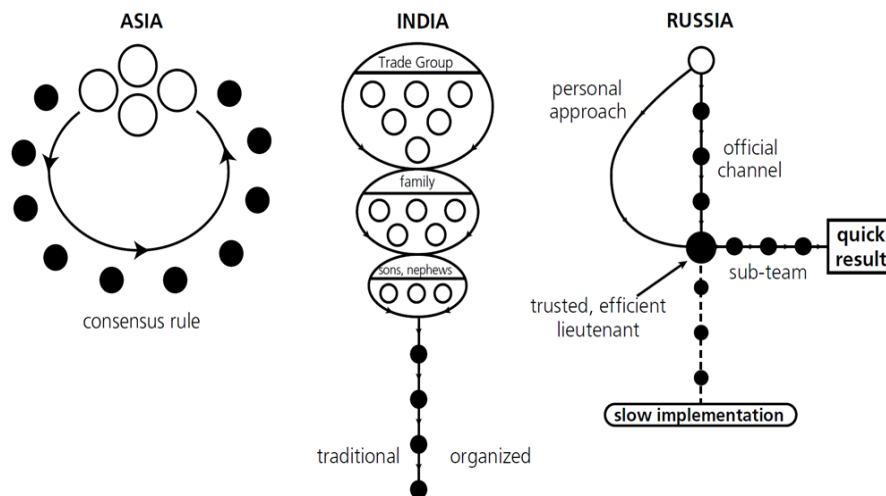
Leadership and principles of business organization can be classified in the same way as in the case of cultural context. The problem is that national differences partially effect the system created, and it is important to consider a corporate culture as such. For example, according to the research performed by Dofman et al. (2004), Chinese, Indian, and Russian cultures are characterized by similar leadership profiles. Specific differences are observed in the context of humane oriented and, to a lesser degree, in the context of autonomous leadership (Figure 2). According to Barrett (2011), Russian, Indian, and Chinese cultures are largely prone to high context communications. Therefore, while the certain cultures have intrinsic differences, the areas of common interest, which create trust, are also in place.





**Fig.2.** Leadership profiles of Chinese, Indian and Russian cultures  
Source: Dofman et al., 2004, pp.713-714

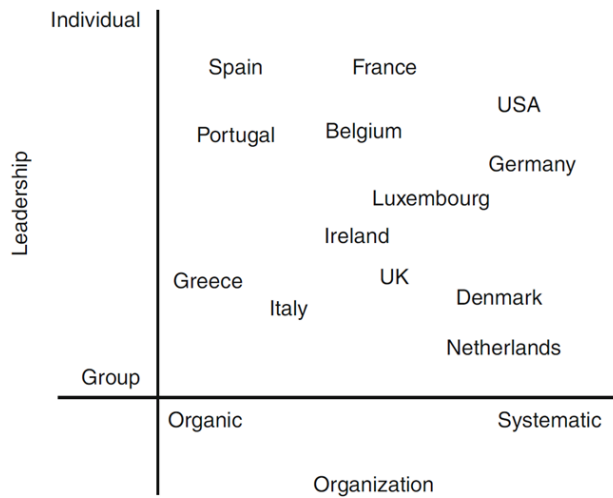
Certain cultural models can be identified in terms of business organization. For example, according to Lewis (2006), Russian companies often face bureaucratic problems within the official channels that forces them to seek for informal relations to game the system and achieve targeted results. Indian companies are characterized by nepotism, which means that key managerial positions are often held by family members, while business relations evolve through the development of kin relations within specific trade groups. In turn, Chinese culture supports Confucianism and is characterized by clear hierarchic relations, cliquish interests, prevailing over personal ones, and strive for consensus (Figure 3). However, despite the existence of cultural specificity to be considered, operational principles of a certain corporation play a key role. It can be concluded that the system of business organization may vary greatly due to the impact created by cultural specificities.



**Fig.3.** Leadership and organization styles in China, India and Russia

Source: Lewis, 2006, pp.108-109

Consequently, while cultural context affects the characteristics of leadership and business organization within a certain company, it is necessary to understand the specificity of internal environment from the perspective of established corporate policies. As this may refer to a wide range of classifications, identifying various approaches to leadership and business organization, Mole's framework (2003) can be used for simplicity. The framework represents a chart that classifies culture by two types of organizations, namely systematic and organic, and by two types of leadership, namely individual and group. Eventually, such approach allows defining to what extent various countries and companies differ from each other in terms of business operations (Figure 4). The application of the proposed model allows emphasizing those differences, which are peculiar to the cultures in terms of leadership and principles of business organization. Consequently, this model is relevant to this research.



**Fig.4.** The 'Mole map'

*Source:* Hurn and Tomalin, 2013, p.55

It is difficult to use a single classification for communications, as each specific culture may require a unique approach. For example, according to Gesteland (2012), Chinese culture requires people to be ready for face-to-face meetings, to keep calm exterior, to avoid continuous visual contact or some hand gestures. To establish business relations with Indians, it is necessary to consider specificities of local English language, body language, pronunciation of names, and bargaining principles. In turn, Russian culture suggests a combination of calm and expressive negotiation styles, high tolerance to alcohol, and granting gifts to the business partners. Consequently, there are various communication systems, which can be affected by both national culture and corporate policies. Therefore, it will be more reasonable to examine the experience of various people from cooperation with other nationalities, as this may refer to unexpected consequences from culture clash (Mole 2003).

In general, it can be concluded that cross-cultural differences in business relations occur at the level of leadership, communications, and principles of business organization. Those differences prevent the foreign counterparties from efficient relations, as each project participant may have a unique idea of the principles of project implementation. However, cultures may have the common points, which may form the basis for trusted relations and consensus searching.

### 3. Methods of data collection

It was necessary to use several methods to collect the relevant data. For example, a desk research was conducted to identify the specificity of oil and gas project. That research was based on corporate reports, presentation materials, and financial calculations of RC. In addition, some open sources of statistical data were used. Mainly

quantitative data was collected, providing insight into the situation under consideration in terms of relations between certain project participants.

Cultural specificities of Chinese, Indian, and Russian parties viewed in the context of leadership and organization have been identified according to Mole model (2003) that describes certain characteristics of systematic and organic organization, as well as individual and group leadership. Those characteristics had been used to develop the online-questionnaires using Qualtrics, which web-link were later sent to the participants of oil and gas project to get the objective insight into cultural specificities of three companies. The web-link was sent via e-mail. Later, a minimum number of completed forms, necessary to derive accurate conclusions, was established.

It is worth to note that the companies, participating in the project, employ tens of thousands of people. Therefore, only those, participating in joint venture, were considered as the population of the research. According to current forecasts, the project will involve 470 people, including 210 people, representing Russian company, and 140 and 120 people, representing Chinese and Indian companies respectively, with no provisions made for outsourcing. 348 participants had completed online-questionnaires as a result of survey, i.e. response rate made 74% (Table 2).

**Table 2.** Sample of the research

Sample	Population	Sample	Request, %
Russian company	210	151	71.9%
Chinese company	140	106	75.7%
Indian company	120	91	75.8%
<b>Total</b>	<b>470</b>	<b>348</b>	<b>74.0%</b>

*Source:* composed by the authors

Various methods of data analysis were used in the course of the research. For example, when examining the specificity of oil and gas project, charts and diagrams have been prepared to visualize the context, within which the relations between the project participants are evolving. Theoretical models that indirectly relate to cross-cultural relations and allow for a better understanding of the organization of the oil and gas project were also used. MS Excel 2016 was used to perform calculations based on survey results. Those calculations allowed to count the percentage of yes/no responses and to visualize the characteristics of oil and gas project participants using the Mole map (2003).

#### 4. Results

The results of the analysis of cross-cultural relationships between the companies involved in a large industry project are outlined below. Based on the results of the survey, 348 respondents had completed the online-questionnaires. Subsequently, the results were analyzed, and the number of answers given for each of the thirty questions was calculated. As a result, an understanding was obtained of the characteristics of the three companies involved in international negotiations, in terms of leadership and principles of business organization. It should be noted that for clarity, respondents' answers were compared with the systematic organization and individual leadership.

First of all, we should pay attention to the principles of business organization of individual companies. We should keep in mind, that managers of Russian companies have been working in the period of economic sanctions, which made them quite accustomed to the changing economic conditions and able to adapt their business processes to the external environment (Schmeleva, Nizhegorodtsev 2018). Also, we should mention the current condition of

social partnership in Russian companies, which is relatively undeveloped nowadays (Denisov, Khachatryan, Umnova 2018). Moreover, the problem of high staff turnover remains relevant for many Russian oil companies, according to annual reports (Plenkina, Osinovskaya 2018). So, in case of RC, detailed planning, monitoring of the implementation of plans, regulation of activities and work functions, regular evaluation of results, observance of the agenda of meetings, the lack of flexible improvised solutions play a big role, as well as a clear differentiation of the personal life and work of employees. Not less than 2/3 of the interviewed specialists have chosen such characteristics for the company. At the same time, there is not always a clear implementation of procedures, in some cases informal decisions could be made, and organization and punctuality are not a critically important requirement. Personal relationships also play a big role in the performance of tasks, and in case of career promotion, they directly affect the final result. In addition, an analytical approach to decision-making is not always appreciated like the accumulated experience. Thus, although in general, RC is inclined towards systematic organization (61% of the answers); certain features of the organic organization play a significant role. In fact, in the presence of sufficiently clear rules and regulations, it is possible that their impeccable performance is optional, since personal interrelations and an informal approach to work influence the work (Table 3).

**Table 3.** Characteristics of RC in the context of systematic organization

Questions	Answers	RC
When decisions are made, do they include detailed action plans?	Yes	78.8%
Do people have to be chased to carry them out?	No	20.5%
Do you have procedure manuals?	Yes	82.8%
Do people rigorously follow procedures?	Yes	57.6%
Do you have an accurate written job description?	Yes	68.2%
Do you have specific goals and targets?	Yes	64.9%
Do you have regular appraisals?	Yes	69.5%
Is analysis more respected than experience in decision making?	Yes	48.3%
Are contacts more important than achievement in getting promoted?	No	20.5%
At a meeting, do people stick closely to the agenda?	Yes	72.2%
Are flexibility and last-minute improvisation common?	No	72.8%
Are important decisions made informally, even outside the office?	No	60.3%
Is it very important to be organized and punctual?	Yes	61.6%
Are home life and office life rigorously separated?	Yes	70.9%
Are personal relationships vital in getting things done?	No	58.9%
<b>Total</b>		<b>60.5%</b>

Source: composed by the authors

Several other features are characteristics of CC. In particular, the company clearly articulates the setting of goals, the adoption of informal solutions is rare, the role of organization and punctuality of employees is high, the results of analytical work are put higher than the accumulated experience, and there is a clear differentiation of professional activity and personal life. At the same time, the role of planning in CC is not so pronounced compared to the Russian company. In addition, the organization does not strictly monitor the current activities of employees, the results achieved are not often evaluated, in most areas there are no clear rules of procedure and job descriptions, meetings are not always held on an approved agenda, and improvised solutions are more frequent. At the same time, the role of personal relations within the Chinese company proves to be significant both in the promotion to work and in the fulfillment of the tasks set. Despite all of the above, in general, about 61% of the answers collected indicate that CC refers to a systematic organization. In general, the company does not have such clear rules and regulations as compared to RC, but it sets specific goals of the work to be consistently performed by employees with the high role of building personal trust relationships with colleagues and superiors. Moreover, decision making in CC does not tolerate an informal approach and is based more on a rational assessment of a certain situation than on the experience gained (Table 4).

**Table 4.** Characteristics of CC in the context of systematic organization

Questions	Answers	CC
When decisions are made, do they include detailed action plans?	Yes	61.3%
Do people have to be chased to carry them out?	No	68.9%
Do you have procedure manuals?	Yes	43.4%
Do people rigorously follow procedures?	Yes	55.7%
Do you have an accurate written job description?	Yes	38.7%
Do you have specific goals and targets?	Yes	87.7%
Do you have regular appraisals?	Yes	58.5%
Is analysis more respected than experience in decision making?	Yes	67.0%
Are contacts more important than achievement in getting promoted?	No	36.8%
At a meeting, do people stick closely to the agenda?	Yes	54.7%
Are flexibility and last-minute improvisation common?	No	61.3%
Are important decisions made informally, even outside the office?	No	81.1%
Is it very important to be organized and punctual?	Yes	84.0%
Are home life and office life rigorously separated?	Yes	88.7%
Are personal relationships vital in getting things done?	No	29.2%
<b>Total</b>		<b>61.1%</b>

*Source:* composed by the authors

Work in IC is completely different. A detailed action plan and strict control over the current work of employees are not of great importance. Work regulations, strict observance of instructions, regular appraisals, organization and punctuality play an insignificant role. The adoption of managerial decisions can be based on both the existing experience and analysis, while they can be taken completely informally, outside the office. At the same time, the Indian company is characterized by a clear statement of the goals of work, high flexibility in decision-making, intertwining of personal and professional life, as well as a significant impact of relationships on the final result, both in promotion issues and in performing tasks set. Thus, in general, IC is a relatively informal and flexible structure where the personal relationships of employees and set working goals play a greater role than specific plans and regulations. Accordingly, it is about organic organization, as evidenced by almost 62% of responses received. At the same time, it should be noted that the flexibility of Indian culture manifests itself even within a large oil and gas corporation characterized by a certain level of regulation and control of operating activities (Table 5).

Thus, it can be concluded that the tendency for regulation of activities and the establishment of clear rules is more characteristic for RC, although in practice they are not always fulfilled. In turn, CC and IC focus more on the implementation of specific objectives, less control over the current activities of employees and welcome a more flexible approach to work. In particular, this concerns a company representing Indian culture. In case of a Chinese company, you can identify a certain propensity for formalism expressed in the organization, punctuality, a clear division of personal and professional life, and rare making important decisions in an informal setting. However, similar features can be found between three participants of the project in the Barents Sea. In particular, employees of three companies are not characterized by strict adherence to procedures. Moreover, building trust relationships, especially in the matter of career growth, plays an important role in each of the organizations studied.

**Table 5.** Characteristics of IC in the context of systematic organization

Questions	Answers	IC
When decisions are made, do they include detailed action plans?	Yes	37.4%
Do people have to be chased to carry them out?	No	74.7%
Do you have procedure manuals?	Yes	45.1%
Do people rigorously follow procedures?	Yes	42.9%
Do you have an accurate written job description?	Yes	35.2%
Do you have specific goals and targets?	Yes	85.7%
Do you have regular appraisals?	Yes	35.2%
Is analysis more respected than experience in decision making?	Yes	47.3%
Are contacts more important than achievement in getting promoted?	No	18.7%
At a meeting, do people stick closely to the agenda?	Yes	8.8%
Are flexibility and last-minute improvisation common?	No	9.9%
Are important decisions made informally, even outside the office?	No	49.5%
Is it very important to be organized and punctual?	Yes	38.5%
Are home life and office life rigorously separated?	Yes	31.9%
Are personal relationships vital in getting things done?	No	16.5%
<b>Total</b>		<b>38.5%</b>

*Source:* composed by the authors

Now proceed to the specifics of the leadership of the analyzed companies. The answers of the respondents representing RC allow us to conclude that in the Russian company important decisions are made by specific managers, the development of a strategic plan is entrusted to top management, most decisions are made without prior consultations with personnel. Moreover, the management of the company does not try to be participative, the work goals are set by immediate supervisors without agreement with the employee, and competition between individual specialists can interfere with team interaction. Accordingly, RC employees are accustomed to contact managers for solving work problems, and meetings and negotiations in the company are supervised by the chairman. Thus, in general, RC is characterized by individual leadership, as evidenced by 67% of responses received. Nevertheless, there are certain features of group leadership, such as the staff awareness of the company's strategy or the consideration of meetings as effective means of problem solving (Table 6).

In case of the Chinese company, many features of individual leadership are more pronounced. For example, CC employees who participated in the questionnaire more clearly understand the sole role of management in making important decisions, developing a strategic plan, determining personal goals for subordinates, and lack of managers' desire to know the opinion of staff. Moreover, many respondents noted that CC managers are not good listeners, and can also keep their distance from subordinates. In addition to this, meetings are held in the company to set clear instructions, not for joint problem solving, and therefore are not organized in the form of a round-Table discussion. At the same time, problems are more often solved at personal meetings. Such facts are characteristic of individual leadership, but the Chinese company also exhibits some bright features of group leadership. In particular, most of the interviewed experts believe that group merits, rather than individual merits, are more taken into account when awarding. Accordingly, the competition between individual employees does not interfere with teamwork, since their activities are focused on the interests of the whole team. A CC employee can address a work problem to a colleague, not a manager. In addition, he has a definite idea of the company's development strategy, and also considers the meeting as an effective enough solution to certain issues. As a result, according to 70% of responses, individual leadership is more characteristic for the Chinese company, although the desire for collectivism also exists (Table 7).



**Table 6.** Characteristics of RC in the context of individual leadership

Questions	Answers	RC
Who makes important decisions?	<i>Individual managers</i>	70.2%
Who develops the strategic plan?	<i>Top management</i>	88.1%
Who knows what the strategy is?	<i>Top management</i>	35.8%
Do decisions need everyone's agreement before they are implemented?	<i>No</i>	80.1%
Are decisions made after full consultation with everyone they affect?	<i>No</i>	75.5%
Do managers keep their distance from subordinates?	<i>Yes</i>	58.9%
Do managers make an effort to be participative and good listeners?	<i>No</i>	78.8%
Who sets your goals and targets?	<i>My manager</i>	82.8%
When achievement is publicly recognized, who are singled out?	<i>Individuals</i>	62.9%
Does competition between individuals get in the way of teamwork?	<i>Yes</i>	69.5%
If you have a work-related problem, who do you go to first?	<i>My manager</i>	70.9%
What are most of the meetings you go to for?	<i>Briefing and instruction</i>	62.9%
Are most of your meetings firmly managed by the chair or round-table discussions?	<i>Controlled by chair</i>	86.8%
If you want something done do you see people individually or call a meeting?	<i>See people individually</i>	46.4%
Are meetings an efficient way to get things done?	<i>No</i>	35.8%
<b>Total</b>		<b>67.0%</b>

*Source:* composed by the authors

Leadership style is in many respects similar to CC in the Indian company. In particular, the managers make unified decisions both at the strategic level and in the context of the objectives of individual employees, without paying attention to the opinion of subordinates and even building a certain distance in the relationship. Accordingly, the meetings in most cases are organized under the control of chair and is necessary for providing specific instructions.

Despite the high role of power, the characteristics of collectivism are also characteristic for the Indian company. This reflects itself in the recognition of group work results, the maintenance of teamwork in a competitive environment between employees, addressing colleagues in solving work problems, and often holding meetings that are considered to be an effective tool. Nevertheless, the centralization of power generally plays a higher role in IC than the focus on the interests of the team. For this reason, 65% of the answers received reveal that the individual leadership is relevant for the Indian company (Table 8).

**Table 7.** Characteristics of CC in the context of individual leadership

Questions	Answers	CC
Who makes important decisions?	<i>Individual managers</i>	87.7%
Who develops the strategic plan?	<i>Top management</i>	95.3%
Who knows what the strategy is?	<i>Top management</i>	50.9%
Do decisions need everyone's agreement before they are implemented?	No	92.5%
Are decisions made after full consultation with everyone they affect?	No	89.6%
Do managers keep their distance from subordinates?	Yes	70.8%
Do managers make an effort to be participative and good listeners?	No	94.3%
Who sets your goals and targets?	<i>My manager</i>	95.3%
When achievement is publicly recognized, who are singled out?	<i>Individuals</i>	19.8%
Does competition between individuals get in the way of teamwork?	Yes	29.2%
If you have a work-related problem, who do you go to first?	<i>My manager</i>	50.9%
What are most of the meetings you go to for?	<i>Briefing and instruction</i>	87.7%
Are most of your meetings firmly managed by the chair or round-table discussions?	<i>Controlled by chair</i>	81.1%
If you want something done do you see people individually or call a meeting?	<i>See people individually</i>	69.8%
Are meetings an efficient way to get things done?	No	40.6%
<b>Total</b>		<b>70.4%</b>

*Source:* composed by the authors

**Table 8.** Characteristics of IC in the context of individual leadership

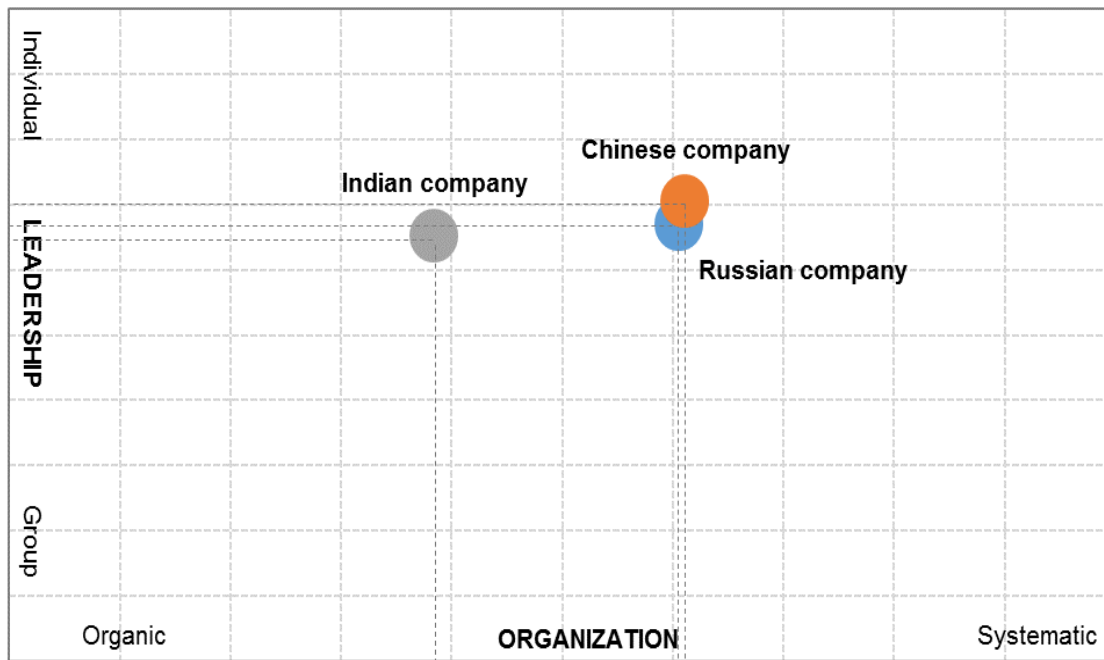
Questions	Answers	IC
Who makes important decisions?	<i>Individual managers</i>	90.1%
Who develops the strategic plan?	<i>Top management</i>	82.4%
Who knows what the strategy is?	<i>Top management</i>	52.7%
Do decisions need everyone's agreement before they are implemented?	No	93.4%
Are decisions made after full consultation with everyone they affect?	No	95.6%
Do managers keep their distance from subordinates?	Yes	84.6%
Do managers make an effort to be participative and good listeners?	No	89.0%
Who sets your goals and targets?	<i>My manager</i>	91.2%
When achievement is publicly recognized, who are singled out?	<i>Individuals</i>	35.2%
Does competition between individuals get in the way of teamwork?	Yes	27.5%
If you have a work-related problem, who do you go to first?	<i>My manager</i>	14.3%
What are most of the meetings you go to for?	<i>Briefing and instruction</i>	74.7%
Are most of your meetings firmly managed by the chair or round-table discussions?	<i>Controlled by chair</i>	82.4%
If you want something done do you see people individually or call a meeting?	<i>See people individually</i>	38.5%
Are meetings an efficient way to get things done?	No	25.3%
<b>Total</b>		<b>65.1%</b>

*Source:* composed by the authors

Based on the comparison of results, it can be concluded that the leadership style of three companies participating in the international project is similar to each other. So, each of the organizations is characterized by the centralization of power, making individual decisions at the strategic and operational level, lack of attention to the opinion and problems of subordinates. However, these characteristics are more pronounced in the Chinese and

Indian companies. Moreover, one can observe the manifestation of collectivism, which is less evident in RC. We also should take into account that the relations between managers and subordinates in each organization are built in their own way. Thus, in the Russian company, the distance between management and personnel is less noticeable, while people often apply to the superior to solve current problems.

Based on the results of the survey, Mole map (2003) was built, which compares the leadership style and principles of business organization (Figure 5).



**Fig.5.** Mole map for RC, CC and IC

*Source:* composed by the authors

Based on the chart, we can conclude that the centralization of power is manifested in each of three companies, so in general they tend to individual leadership. Nevertheless, there is a noticeable gap in organization, as the Indian company is more organic and flexible than its partners. At the same time, based on the results of the analysis, in reality, each of three companies has a certain specificity. That is, in general, we can conclude that the difference between partners exists both at the cultural and organizational level.

## Conclusion

On the one hand, it is determined that the Russian and Chinese companies tend to have a systematic organization, while the Indian party more supports the organic organization. At the same time, there is a wide range of differences between three participants of the oil and gas project, related to the issues of planning and regulating activities, focusing on goals, monitoring current activities, building relationships and other issues. On the other hand, each company adheres to individual leadership. This is due to the centralization of power, the adoption of individual decisions, and insufficient attention to the problems of subordinates. However, it should be taken into account that such characteristics are more pronounced for the Chinese and Indian parties of the negotiations, as well as the manifestation of the features of collectivism. In general, while according to the classification proposed by Mole (2003) the international partners may adhere the similar models of leadership and business organization, more detailed analysis may reveal the significant differences between those models. This may be about different approaches to planning, activity control, goals design, and the role of relationships for career and work, separation

of private and professional life from the perspective of the organization. In turn, from leadership perspective, the differences may relate to the involvement of the personnel into tactical and strategic decision-making process, result assessment, personal competition, approaches to meeting with managers and subordinates.

## References

- Barrett, D.J. (2011) Leadership communication, 4th ed., New York: McGraw-Hill Education: 153-190.
- Denisov, I.V., Khachatryan, M.V., Umnova, M.G. 2018. Corporate social responsibility in Russian companies: Introduction of social audit as assurance of quality. *Quality - Access to Success* 19(164): 63-73.
- Dofman, P.W., Hanges, P.J. and Brodbeck, F.C. 2004. "Leadership and cultural variation: the identification of culturally endorsed leadership profiles" in House, R.J., Hanges, P.J., Javidan, M., Dofman, P.W. and Gupta, V. (eds.), *Culture, leadership and organizations: the GLOBE study of 62 societies*, London: SAGE Publications Ltd.:669-719.
- Gesteland, R.S. 2012. Cross-cultural business behaviour: a guide for global management, 5th ed., Copenhagen: Copenhagen Business School Press: 25-91.
- Girdzijauskaitė, E.; Radzeviciene, A., Jakubavicius, A. 2019. Impact of international branch campus KPIs on the university competitiveness: FARE method, *Insights into Regional Development* 1(2): 171-180. [https://doi.org/10.9770/ird.2019.1.2\(7\)](https://doi.org/10.9770/ird.2019.1.2(7))
- Hurn, B.J. and Tomalin, B. 2013. Cross-cultural communication: theory and practice, Basingstoke: Palgrave Macmillan: 55-61.
- Kazanský, R., Andrassy, V. 2019. Conflict resolution approaches towards smart sustainability of internal relations, *Entrepreneurship and Sustainability Issues* 6(3): 1468-1484. [https://doi.org/10.9770/jesi.2019.6.3\(29\)](https://doi.org/10.9770/jesi.2019.6.3(29))
- Lewis, R.D. 2006. When cultures collide: leading across cultures, 3rd ed., London: Nicholas Brealey Publishing: 45-114.
- Maslennikov, V.V., Chernitsova, K.A. 2017. Evaluation of the organizational and technical level of a company transitioning into the sixth innovation mode. *MATEC Web of Conferences* 121. 07012. <https://doi.org/10.1051/mateconf/201712107012>
- Mole, J. 2003. Mind your manners: managing business cultures in Europe, 3rd ed., London: Nicholas Brealey Publishing: 114-167.
- Muradli, N., Ahmadov, F. 2019. Managing contradiction and sustaining sustainability in inter organizational networks through leadership: a case study, *Entrepreneurship and Sustainability Issues* 6(3): 1255-1269. [https://doi.org/10.9770/jesi.2019.6.3\(14\)](https://doi.org/10.9770/jesi.2019.6.3(14))
- Plenkina, V. V., Osinovskaya, I. V. 2018. Improving the system of labor incentives and stimulation in oil companies, *Entrepreneurship and Sustainability Issues* 6(2): 912-926. [https://doi.org/10.9770/jesi.2018.6.2\(29\)](https://doi.org/10.9770/jesi.2018.6.2(29))
- Pozdniakov K.K., Le Z.A. 2016. The problem of formation of corporate culture in the process of mergers and acquisitions, *Innovative development of the economy* 6-2 (36): 71-74. (In Russian).
- Rugman, A.M., Collinson, S. and Hodgetts, R.M. 2006. International business, 4th ed., Harlow: Pearson Education Limited: 142-147.
- Schmeleva, A., Nizhegorodtsev, R. 2018. Management quality in Russia: The goal or means? *Quality - Access to Success*. 19: 57-63.
- Shakhovskaya, L., Petrenko, E., Dzhindzholia, A., Timonina, V. 2018. Market peculiarities of natural gas: case of the Pacific Region, *Entrepreneurship and Sustainability Issues* 5(3): 555-564. [https://doi.org/10.9770/jesi.2018.5.3\(11\)](https://doi.org/10.9770/jesi.2018.5.3(11))
- Schein, E.H. (2010) Organizational culture and leadership, 4th ed., San Francisco: Jossey-Bass: 25-85.
- Steers, R.M., Sanchez-Runde, C.J. and Nardon, L. 2010. Management across cultures: challenges and strategies, New York: Cambridge University Press: 24-76.

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## INNOVATIVE MECHANISM FOR LOCAL TOURISM SYSTEM MANAGEMENT: A CASE STUDY\*

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**Abstract.** The purpose of the study is to provide a theoretical justification and offer practical recommendations on the effective formation and functioning of an innovative mechanism for managing local systems in the tourism and recreation sector. The study presented in the article examines issues of local tourism system management through the example of tourism and recreation in the Volga Federal District, Russia. The authors analyse conceptual approaches to innovative management of local tourism and recreation systems and propose an innovative mechanism for local systems management in the Volga Federal District.

**Keywords:** innovations; innovativeness; tourism and recreation; management; local systems; Russia

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**JEL Classifications:** O32, P40, Z32.

### 1. Introduction

Tourism is one of the fastest growing and most promising sectors of the world economy, with a vital contribution to the economic strength and social development, and high potential for long-term growth. In the last decades, this sector has become a key driver for socio-economic progress (UNWTO, 2018). For many regions, tourism is the most important source of income, job creation, and property reduction (Benavides, Pérez-Ducy, 2001; de Freitas, 2003; Goodwin, 2008; Cárdenas-García et al., 2015; Roberts et al., 2017). However, tourism destination governance is a very complicated management activity. Tourism is a highly fragmented industry, geographically dispersed with many small specialist businesses contributing to an overall product experience (Czernek, 2017). In

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this perspective, there is a need to identify tourism destination as a complex system (Baggio et al., 2010). Essentially, “a local tourism destination is a physical space in which a visitor spends at least one overnight. It includes tourism products such as support services and attractions, and tourism resources within one day’s return travel time. It has physical and administrative boundaries defining its management, images and perceptions defining its market competitiveness. Local tourism destinations incorporate various stakeholders often including a host community, and can nest and network to form larger destinations” (UNWTO, 2016).

The current conditions of growing diversity and severe competition in the tourism market, on the one side, and growing demands and needs of tourists, on the other side, make it necessary to look for innovative decisions, for new sources of destination competitiveness (Zolotukhina, 2009; Almobaideen et al., 2017; Panfiluk, Szymańska, 2017; Sheresheva, 2018; Shevyakova et al., 2019).

Therefore, there is a need to develop innovative local systems in tourism that are complex networks, based on new ideas and approaches, services and products. Managing innovation within such networks is crucial for sustainability and long-term success of any contemporary destination (Mingaleva et al., 2017; Zach, Hill, 2017; Biemans, 2018).

UNWTO (2010) offered recommendations on the innovative policy development in tourism and defined the priority goals in this field. These recommendations are as follows:

- 1) economic and innovative vitality (to assure competitiveness and development of innovative products in tourist destinations);
- 2) employment quality (to facilitate an increase in quality and quantity of workplaces created and supported by the tourism sector);
- 3) local control (to encourage local communities participation);
- 4) innovative resources effectiveness (to develop innovative projects);
- 5) accessible tourism (to ensure a safe and comfortable environment for tourism).

However, there are impediments to innovative growth in many new tourism destinations, especially in those in developing countries (Benavides, Pérez-Ducy, 2001; Najda-Janoszka, Kopera, 2014), including Russia. The major barriers are weak infrastructure, scarcity of financial and human resources, low activity of local communities, and unfriendly institutional environment. Therefore, the development of innovative management mechanism for local tourism systems is a highly urgent task.

In this research, the authors proposed an innovative mechanism for managing local tourism systems and tested it on the example of the Volga Federal District regions, Russia.

This article is structured as follows. Section 2 presents an overview of the literature on the issues of innovations, with the focus on innovative local tourism systems, networking, system planning and spatial planning approach. In Section 3, an innovative mechanism for local systems management in tourism is proposed. In Section 4, the methodology of evaluation on the base of ranking the Volga Federal District regions is presented. A case study of the Mari El Republic presented in Section 5 shows the approach to the classification of innovative sectors in local tourism systems management, as well as the analysis of the main tourist potential indicators. Finally, conclusions and suggestions for future research are provided.

## 2. Literature review

The main issues of researcher interest concerning innovativeness in the economy include innovation policy, the innovation drivers in the economy, innovativeness in the context of a knowledge-based economy and in the globalization process, and the innovative activity of enterprises, with particular consideration given to technological progress and R&D expenditure (Panfiluk, Szymańska, 2017). There is also a growing amount of academic literature on sector-specific innovativeness (Malerba, 2002; Garcia-Altes, 2005; Gallouj, Savona, 2009; Garcia, Hollanders, 2009; Krasnyuk et al., 2017), including research on innovation in hospitality and tourism (Hjalager, 2010; Bilgihan, Nejad, 2015; Gomezelj, 2016; Marasco et al., 2018).

In the twenty-first century, the focus of research came to the innovativeness of tourism enterprises (Sundbo et al., 2007; Nybakk, Hansen, 2008; Hjalager, 2010; Walsh et al., 2010; Szymańska, 2015); measuring innovations in tourism (Camison, Monfort-Mir, 2012; Volo, 2012); networking in tourism as a way to sustainable client-oriented innovations (Baggio, Sainaghi, 2016; Camison, Monfort-Mir, 2012; Aarstad et al., 2015); tourism entrepreneurship and regional development (Ateljevic, 2017; Mingaleva et al., 2017). Also, the issues of modeling innovative mechanism for local tourism systems management remain one of the hot topics (Omerzel, 2015).

The initial attempts to define innovative local tourism systems, and to unveil factors playing the key role in the development of innovative tourism systems, belong to the last decades of the twentieth century. Leiper (1979) described innovative local systems as the interrelation between a number of elements, namely a region that considers the concentration of tourist flows as its main goal, a tourist destination with innovative infrastructure and a particular environment (sociocultural, innovative, legal, political, etc.). In Europe, major characteristic features of innovative local systems development were depicted as follows: 1) emerging of innovative approaches including acquisition of new knowledge and familiarization with new technologies in the innovative local systems (Geschka, Hubner, 1992); 2) integration of recreation and travel conditions for meeting the needs of different tourist target groups (Davidson, Maitland, 1997; Buhalis, 2000). Resting upon the European studies on tourism, Prosser (1994) proposed an innovative local tourism system model. This model pays special attention to an internal description of a tourist destination that consists of the environment, innovative attractions, high-quality services, innovative technologies in the destination, and the local population.

In the same period, the Regional Innovation System (RIS) concept was introduced (Cooke, 1992; Cooke et al., 1998). Cooke (1992) specified the RIS concept as the prelude to an extended discussion of the importance of financial capacity, institutionalized learning and productive culture to systemic innovation. Nelson (1993) defines RIS as a system composed of regional system, regulations and practices to guide the yielding of innovation. Some researchers suggested consideration of RIS as an interactive, dynamic structure made up of partners in the regional production (Lambooy, 2002) or even as a kind of complex adaptive system (Cooke, 2013). Following Cilliers (1998), it is possible to characterize a system as complex and adaptive by listing a number of main properties. These properties are as follows:

- 1) a large number of elements form the system;
- 2) interactions among the elements are nonlinear and usually have a somewhat short range;
- 3) there are loops in the interactions;
- 4) complex systems are usually open and their state is far from equilibrium;
- 5) each element is unaware of the behavior of the system as a whole, it reacts only to information or perturbations available to it locally;
- 6) complex systems have a history;
- 7) the “future” behavior depends on the past.

Such a system cannot be broken down in sub-elements and understood by analyzing each of them but should be understood only by analyzing it as a whole (Baggio, 2008; Baggio, Sheresheva, 2014).

For Russia, Postaliuk et al. (2017) proposed to enhance the management potential of economic entities in local economic systems by the introduction of a number of properties that compose the structure of the innovative economic system. These properties are as follows (Karimullina, Postalyuk, 2017): 1) self-similarity; 2) self-regulation; 3) self-organization; 4) self-education; 5) innovation 6) control. Actually, regarding tourism and recreation sphere, this is the usual logic of RIS, from the one side (Isaksen, 2001; Iammarino, 2005), and tourism destination networking, from the other side (von Friedrichs Grängsjö, Y. 2003; Lazzeretti, Petrillo, 2006; van der Zee, E.; Vanneste, 2015). There is a need for close coordination and integration of specialized resources and activities provided by interdependent, yet autonomous actors, in order to deliver the destination product (Aarstad et al., 2015). In accordance with this logic, Butler and Hinch (2007) put a tourist destination and elements interacting with it (an innovative infrastructure, financial resources, tourist flows, etc.) into the center of the innovative local system.

The main goals of local tourism system management are to increase the efficiency of the tourism and recreation sector and to ensure sustainable regional development (Buhalis, 2000). To achieve these goals, an innovative management mechanism development is important.

### 3. An innovative mechanism for local tourism system management

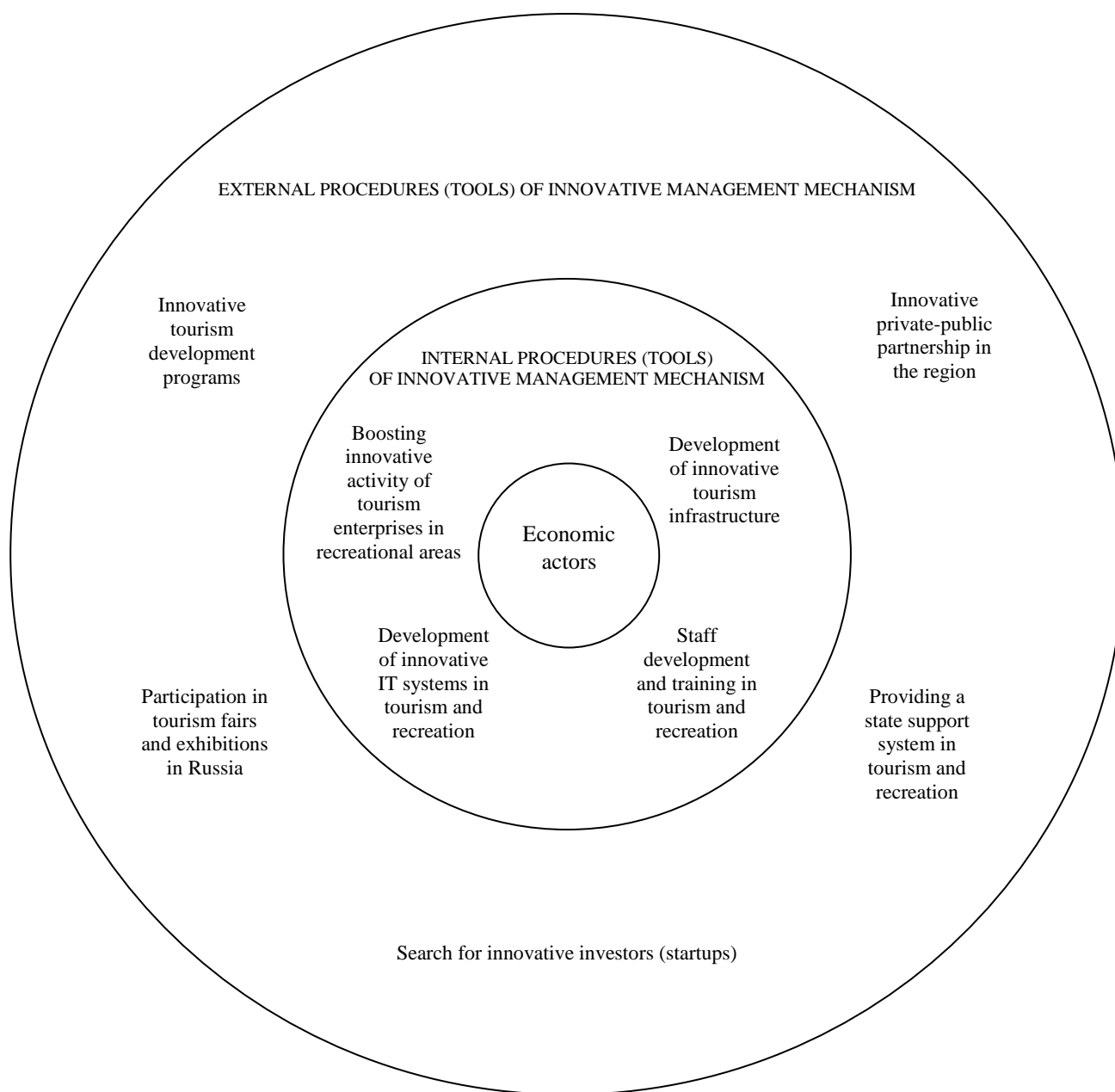
The innovative mechanism for local systems management, presented in Figure 1, includes a combination of rules, procedures, and tools of decision-making by a managing subject that can affect the economic actors' behavior.

In this study, the term *economic actors* refer to multilevel local systems that conduct their innovative activity based on the combinations of rules, i.e. legal acts. Innovative management procedures include innovative management tools that influence the behavior of economic actors. We divide the innovative procedures and tools into internal and external ones. Implementation of the innovative mechanism for management of local tourism systems facilitates revealing of the existing business problems and defining the ways of their solution. As a result, the increase in the effectiveness of local tourist and recreational potential can be achieved.

We consider the following external innovative procedures for the tourist and recreational sector in Russia:

- 1) development of innovative public-private partnerships;
- 2) systematic public support for the industry;
- 3) search for innovative investors;
- 4) participation in national travel and tourism fairs and exhibitions;
- 5) development of innovative programs for industry improvement.

For each external innovative procedure, we have developed a set of innovative tools and their detailed descriptions.



**Figure 1.** The innovative mechanism of local tourism system management

Source: developed by the authors

Further, we will show the relationship between innovative procedures and innovative tools on the example of the internal procedures used in the regions of the Volga Federal District.

The internal innovative procedure called *Qualification improvement and retraining of human resources in the tourism and recreation sector* consists of the following internal innovative tools:

- personnel certification;
- qualification upgrading courses;
- practical training courses and internships;
- distance courses and seminars;
- business training;
- professional information resources use and knowledge exchange between employees;
- qualifying exams.

The second internal innovative procedure called *Development of innovation infrastructure in the tourism and recreation sector* includes the following internal innovative tools:

- improvement of transport infrastructure conducive to the realization of opportunities for the timely arrival of tourist groups;
- elaboration projects for new tourism enterprises development and for new facilities construction;
- implementation projects for the creation of tourist complexes, recreation areas, museums, etc.;
- deployment measures for restoration historical and cultural sites (monuments) in local systems.

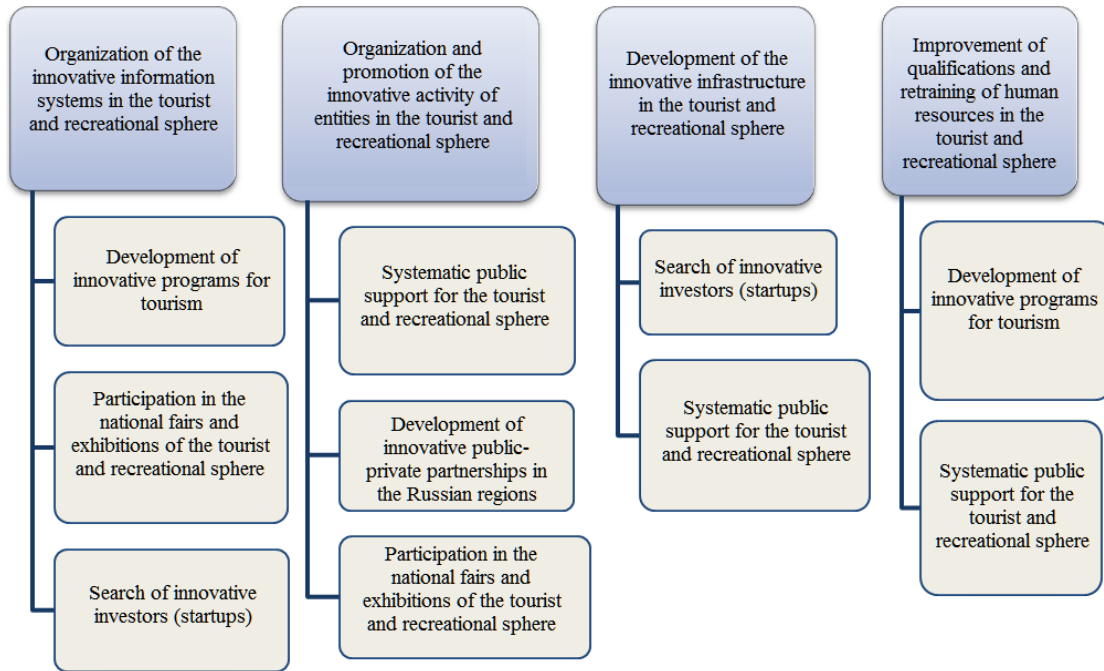
The third internal innovative procedure called *Organization of innovative information systems in the tourist and recreational sector* involves the following internal innovative tools:

- monitoring tourism firms websites, with the aim to reveal the existing problems that concern text information and images on the website, visiting statistics, as well as to the arrangement of the main elements of the website and their configuration;
- redesigning of the websites if needed;
- introduction a unified IT system for the collective accommodation facilities management on the regional level, that will help to simplify coordination and control over different types of hotels activity.

The fourth internal innovative procedure called *Organization and promotion innovation activities of enterprises in the tourism and recreation sector* implies the following internal innovative tools:

- revealing key indicators to evaluate the innovative processes effectiveness;
- development instruments for boosting innovative processes in tourism enterprises;
- evaluation of the innovative activity effectiveness of tourism enterprises;
- introduction of additional tools to stimulate innovation processes in tourism enterprises.

The proposed algorithm of interrelation between the external and internal tools is as shown in Figure 2.



**Fig. 2.** The algorithm of interrelation between the external and internal tools of the innovative mechanism for local tourism system management

*Source:* developed by the authors

#### 4. The methodology of evaluating local innovative tourism systems management on the base of ranking the Volga Federal District regions

The regions under analysis were ranked according to the annual (monthly) indicators that account revenues and expenses. The results of such ranking are used for plotting two different graphs that demonstrate the results of region ranking according to a tourist potential and characterize the revenues from commercial tourist services and tourist facilities in the regions. The results of the analysis allow for revealing groups of regions described as leader regions, middle regions, and outside regions. The analysis of tourist attractiveness of the Volga Federal District regions shows that over the past five years the following regions have demonstrated the indicators deterioration: the Perm Region, the Saratov Region, the Mari El Republic, the Penza Region, the Kirov Region, and the Ulyanovsk Region. The causes of deterioration are the state of the natural recreational environment, lack of due attention to historical and cultural complexes, to the development of the tourist infrastructure. The Republic of Tatarstan, the Udmurt Republic, the Chuvash Republic, and the Orenburg Region have improved their position in the ranking over recent five years. The situation in these regions has improved due to the organizing big newsworthy events, the construction of new recreation and entertainment facilities, and the intensive development of accommodation facilities. Table 1 shows the data on the revenue and expense indicators in the tourist and recreational sphere, obtained using the authors' methodology, and the data on the tourist potential indicators.



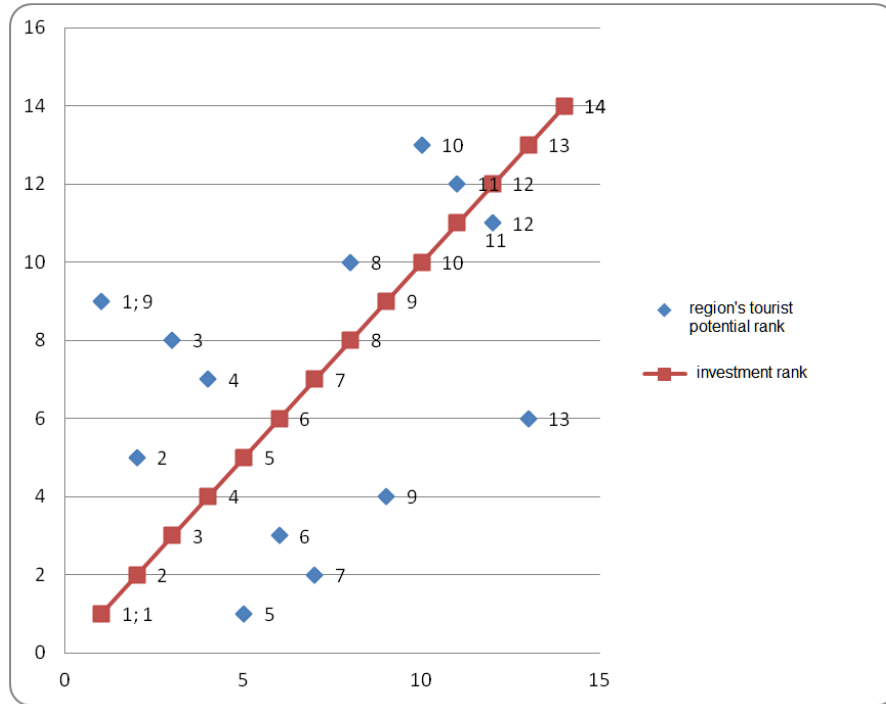
**Table 1.** Effectiveness of achieving a tourist potential:  
a case study of the Volga Federal District (its regions)

Region of the Volga Federal District	Rank of financial investments in tourism in the analyzed region	Rank of the tourist and recreational potential	Rank of the analyzed region revenues
Mari El Republic	5	1	2
Ulyanovsk Region	7	2	4
Republic of Mordovia	6	3	1
Penza Region	9	4	3
Udmurt Republic	2	5	9
Chuvash Republic	13	6	7
Kirov Region	4	7	8
Orenburg Region	3	8	6
Saratov Region	1	9	5
Samara Region	8	10	10
Perm Region	12	11	11
Nizhny Novgorod Region	11	12	12
Republic of Bashkortostan	10	13	14
Republic of Tatarstan	14	14	13

*Source:* study results

Figure 3 shows a diagram of distribution of the regions due to the correlation of the investment rank and the tourist potential rank.

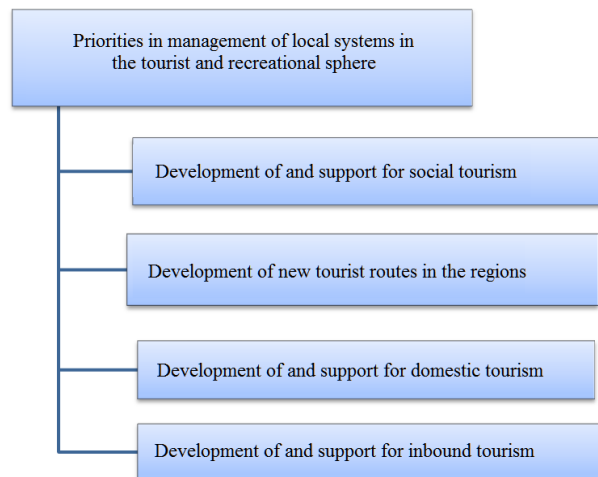
The diagram represented in Figure 3 distributes the regions in dependence of correlation of the rank of investments and the rank of tourist potential. The regions of the Volga Federal District are indicated by figures according to the rank of their tourist potential. When analyzing the group of regions above the diagonal line, one should especially highlight the Nizhny Novgorod Region and Samara Region, as well as Bashkortostan. These regions demonstrate quite high investments ranks and tourism potential ranks. The indicators of potential are somewhat higher than investments ranks. That evidence about rather high effectiveness of achieving their potential. At the same time, one can indicate prospects of attracting more investors for even more impressive results in achieving their tourism potential.



**Fig. 3.** Tourism potential evaluation of the Volga Federal District regions

*Source:* study results

According to the approaches adopted in contemporary Russia, the development of local systems in the tourist and recreational sphere implies an emphasis on the following priority directions (Figure 4).



**Figure 4.** The priority directions of local tourism systems management

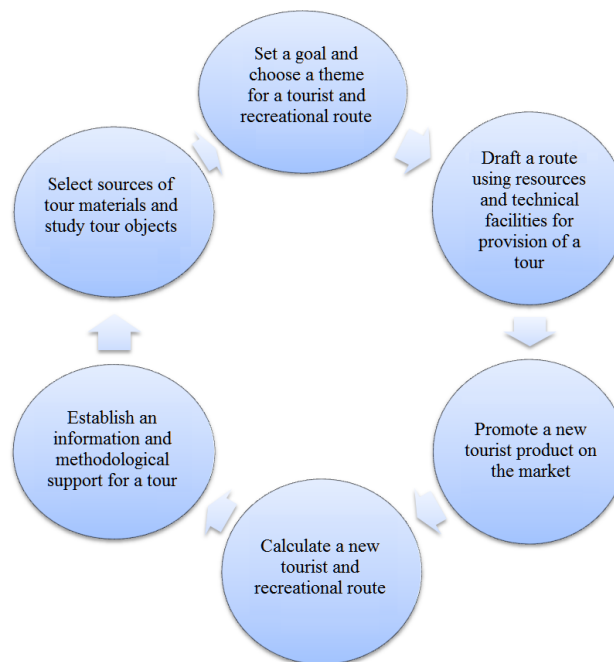
*Source:* developed by the authors

Each of the priority directions outlined has its own particular features of innovative development.

1. *Development of and support for social tourism.* In the Russian Federation, social tourism develops within a number of regions. Still, this market segment is not sufficiently developed. The priority directions analysis allows us to reveal the main innovative factors to support intensive development in this direction:

- the overall focus on attaining a number of social objectives: rendering non-material values, raising the educational and cultural level of the population, reduction of income inequality, relieving of socio-psychological tension in the society;
- the attention to patriotic education of young people who should cherish the memory of important events in Russian history;
- the country image improvement. It is one of the main factors of social tourism development, as well as any other sector of the tourism market.

2. *Development of new tourist routes in the regions.* The development of a unique tourist product is one of the most important directions of the innovative activity in the tourist and recreational sphere. Therefore, the authors paid special attention to the methodology of innovative tourist routes development (Figure 5).



**Fig. 5.** The methodology of innovative tourist routes development

*Source:* developed by the authors

The main innovative factors of this direction are:

- the client-oriented smart policy, with the special focus on relevant skills of operating personnel;
- careful attention to all features of the tourist route, to meet interests, wishes, and requests of clients;

- building a positive image of the local tourist area, including the improved reputation of all enterprises engaged in servicing tourists;
- provision of high-quality information about leisure opportunities, entertainment, sightseeing activities, etc. on both local and regional markets.

3. *Development of and support for innovative domestic tourism.* The results of many studies show that the externalities of tourism, including at the local level, are both positive and negative. The main concerns in the Russian domestic tourism development are not only the lack of a high-quality tourist product and necessary infrastructure but also neglecting the local communities attitude and interests, as well as insufficient consideration of environmental issues when planning tourism development. To unite efforts in improvement domestic tourism results, it is necessary to elaborate development plans for each region and to coordinate these plans on the federal level, taking in account the need to balance interests of all tourism market stakeholders.

4. *Development of and support for inbound tourism.* The main innovative factors of this direction are:

- establishment of innovative specialized infrastructure in the local tourism systems of the Volga Federal District;
- development of up-to-date monetary instruments to be used in tourism business;
- ensuring high-quality customer service in the field;
- increasing state support in the issues relating to development of inbound tourism.

## 5. The case study of the Mari El Republic

In order to reveal the main indicators of tourist and recreational service volumes for implementation of the program «Innovative development potential of the tourist and recreational sphere in the Mari El Republic», we applied correlation and regression analysis. In Table 2, there are the input data for this analysis.

**Table 2.** The input data for correlation and regression analysis

Volume of tourist services, million rubles (Q)	Tourist flow, thousand people (N)	Annual per capita income, thousand rubles (I)	Index of prices for leisure services (P)
581.7	291.5	291.8	1.11
710.1	360.3	332.7	1.04
696.7	420.5	346.4	1.07
711.3	570	366.9	1.14

Source: compiled by the authors

The correlation matrix was analysed to select variables for the multiple regression model (Table 3).

**Table 3.** The matrix of paired coefficients of correlation

Indicator description	Volume of tourist and recreational services (Q)	Tourist flow (N)	Per capita income (I)	Index of prices (P)
Volume of tourist and recreational services	1	-	-	
Tourist flow	0.689776115	1	-	
Per capita income	0.900219299	0.926511952	1	
Index of prices	-0.27162447	0.505152195	0.14771438	1

Source: study results

Analysis of the matrix data has shown: firstly, a strong relationship between the volume of tourist services, tourist flow and average per capita income; secondly, the relationship between tourist flow and per capita income, indicating the presence of multicollinearity, which will distort the result of the study. To eliminate multicollinearity, we excluded from the regression equation the indicator of tourist flow, which has a lower relationship with the volume of tourist and recreation services. The main obtained indicators of regression statistics demonstrate the tight relationship between the obtained values. The data listed in table 4.

**Table 4.** The main indicators of obtained regression statistics

Multiple R	0.98811076
R-squared	0.977747345
Normalized R-squared	0.933242034
Standard error	16.15310631
Observations	4

While designing the main indicators of regression statistics, we revealed the equation for the dependence of tourist and recreational services on these factors, expressed as follows:

$$Q = 682,25 + 1,89I - 588,12P$$

This equation shows the direct relationship of the tourist services volume with per capita income and the inverse relationship with the price index for leisure services. Partial elasticity coefficients show high elasticity of these services to the population income (1.89) and single elasticity to the price change (0.95).

The equation is applicable to forecast the main volume of tourist and recreational services in the Mari El Republic. The goals will be achievable only in case if target indicators and actual indicators will be equal to one or higher than one.

The organization, control, and management of the program “Innovative development potential of the tourism and recreation sphere in the Mari El Republic” may become the responsibility of the Ministry of Youth Policy, Sports and Tourism of the Mari El Republic.

Our case study also confirmed that for improving the development indicators of the tourist and recreational sphere in the perspective of the public authorities' influence it is necessary:

- to ensure accessibility of the tourist and leisure services for all social segments, both for local people and tourists from other countries and regions visiting the Mari El Republic;
- to improve the infrastructure, and to establish a favorable institutional environment for tourism development in the Mari El Republic, including business, local communities' and tourists' rights protection.

## Conclusions

In the context of globalized processes and market segments, the importance of innovations and sustainability in solving the problems of local tourism systems development is growing. There is an obvious need to create prerequisites for increasing innovation activity, and for shaping promising areas of local tourism development. The manifestation of innovative activity through the innovation process creates the conditions for the sectoral economic development and tourism services quality improvement. Economic, financial and organizational influences on the part of different tourism destination stakeholders, including federal and regional authorities, are crucial for creating a system of individual self-regulation measures.

To form an innovative mechanism and to implement innovative ideas, it is necessary to develop local tourism systems aimed at creating new tourist resources and products, to stimulate their growth and competitiveness. The complexity of the innovative development process in tourism destinations is stipulated by the interaction of consumers, local communities, public administration bodies, as well as tourist firms. All destination stakeholders' activity is regulated by legal norms and rules. Therefore, institutional environment making a framework for the innovative activity in tourism is especially important.

The study presented in the paper allowed to determine the theoretical and methodological foundations, and to identify conceptual approaches to the development of an innovative mechanism for managing local tourism systems. We studied the current state and development trends of local tourism systems in the Volga Federal District of Russia and analyzed the selected areas of local tourism systems management. For the Mari El Republic, we revealed major opportunities and threats, as well as factors of the local tourism system competitiveness; the developed program "Innovative development potential of the tourist and recreational sphere in the Mari El Republic" defines target indicators and forecasts the volume of financial investments needed to the successful program fulfillment.

The study results showed that the relevance of the innovative local system development is largely dictated by the current situation in the Russian economy, and by the ever-increasing role of integration processes in innovative interaction on the regional and interregional levels. This, in turn, contributes to the importance of further studying and applying innovative mechanisms and instruments of influence on current economic processes in tourism.

## References

- Aarstad, J.; Ness, H.; Haugland, S. A. 2015. Innovation, uncertainty, and inter-firm shortcut ties in a tourism destination context. *Tourism Management* 48: 354-361.
- Almobaideen, W.; Krayshan, R.; Allan, M.; Saadeh, M. 2017. Internet of Things: Geographical Routing based on healthcare centers vicinity for mobile smart tourism destination. *Technological Forecasting and Social Change* 123: 342-350.
- Ateljevic, J. 2017. Tourism entrepreneurship and regional development. *Tourism and Entrepreneurship*, 149.
- Baggio, R.; Sainaghi, R. 2016. Mapping time series into networks as a tool to assess the complex dynamics of tourism systems. *Tourism Management* 54: 23-33.



- Baggio, R.; Scott, N.; Cooper, C. 2010. Improving tourism destination governance: a complexity science approach. *Tourism Review* 65(4): 51-60.
- Benavides D. D.; Pérez-Ducy E. 2001. Tourism in the Least Developed Countries. Retrieved from: <https://www.e-unwto.org/doi/abs/10.18111/9789284404513> [16.03.2019].
- Biemans, W. (2018). Managing innovation within networks. London: Routledge.
- Bilgihan, A.; Nejad, M. 2015. Innovation in hospitality and tourism industries. *Journal of Hospitality and Tourism Technology* 6(3). <https://doi.org/10.1108/JHTT-08-2015-0033>
- Buhalis, D. 2000. Marketing the competitive destination of the future. *Tourism Management*, 21(1): 97-116.
- Butler, R.; Hinch T. 2009. Tourism and indigenous peoples: Issues and implications: 205-212.
- Camison, C.; Monfort-Mir, V.M. 2012. Measuring innovation in tourism from the Schumpeterian and the dynamic – capabilities perspectives. *Tourism Management* 33: 776-789. <http://dx.doi.org/10.1016/j.tourman.2011.08.012>
- Cilliers, P. (1998). Complexity and Postmodernism: Understanding Complex Systems. London, UK: Routledge.
- Cooke, P. 1992. Regional innovation systems: competitive regulation in the new Europe. *Geoforum*, 23(3): 365-382.
- Cooke, P.; Uranga, M.; Etxebarria, G. 1998. Regional systems of innovation: an evolutionary perspective, *Environment and Planning* 30: 63-84.
- Cooke, P. 2013. Complex adaptive innovation systems: Relatedness and transversality in the evolving region. New York, NY: Routledge.
- Czernek, K. (2017). Tourism features as determinants of knowledge transfer in the process of tourist cooperation. *Current Issues in Tourism* 20(2): 204-220.
- de Freitas, C. R. 2003. Tourism climatology: evaluating environmental information for decision making and business planning in the recreation and tourism sector. *International Journal of Biometeorology* 48(1): 45-54.
- Davidson, R.; Maitland, R. 1997. Tourism destinations. London: Hodder & Stoughton.
- Gallouj, F.; Savona, M. 2009. Innovation in services: a review of the debate and a research agenda. *Journal of evolutionary economics*, 19(2): 149. <https://doi.org/10.1007/s00191-008-0126-4>
- García-Torres, M. A.; Hollanders, H. J. G. M. 2009. The diffusion of informal knowledge and innovation performance: a sectoral approach. (UNU-MERIT Working Papers; No. 013). Maastricht: UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology.
- García-Altes, A. (2005). The development of health tourism services. *Annals of Tourism Research*, 32 (1), 262-266.
- Cárdenas-García, P. J.; Sánchez-Rivero, M.; Pulido-Fernández, J. I. 2015. Does tourism growth influence economic development? *Journal of Travel Research* 54(2): 206-221.
- Geschka H.; Hubner H. 1992. Innovation strategies: 416.
- Gomezelj, D. O. 2016. A systematic review of research on innovation in hospitality and tourism. *International Journal of Contemporary Hospitality Management* 28(3): 516-558.
- Goodwin H. 2008. Tourism, local economic development, and poverty reduction. *Applied Research in Economic Development* 5 (3): 55-64.
- Hjalager, A. M. 2010. A review of innovation research in tourism. *Tourism Management* 31(1): 1-12.
- Iammarino, S. 2005. An evolutionary integrated view of regional systems of innovation: concepts, measures and historical perspectives, *European Planning Studies* 13: 497-519.
- Isaksen, A. 2001. Building regional innovation systems: is endogenous industrial development possible in the global economy? *Canadian Journal of Regional Science* 24(1): 101-120.
- Karimullina, A.I.; Postalyuk, M. P. 2017. Innovation of managerial potentials of economic entities in local economic systems. *Contemporary Economy Issues* 1(61): 135-139. (In Russian).
- Konyusheva, O. N. 2016. The essence and structurization of the national innovation system of Russia at present 5(6): 381-386.
- Krasyuk, I. A.; Bakharev, V. V.; Medvedeva, Y. Y. 2017. Sector specific features of innovative development in the Russian economy. *SHS Web of Conferences* (Vol. 35, p. 01052). EDP Sciences.

- Lambooy, J. G. 2002. Knowledge and urban economic development: an evolutionary perspective. *Urban Studies* 39(5-6): 1019-1035.
- Lazzeretti, L.; Petrillo, C. S. (Eds.). 2006. *Tourism local systems and networking*. London: Routledge.
- Leiper, N. 1979. The framework of tourism: towards a definition of tourism, tourist and the tourist Industry. *Annals of Tourism Research* 6(4): 390-407.
- Malerba, F. 2002. Sectoral systems of innovation and production. *Research policy* 31(2): 247-264.
- Marasco, A.; De Martino, M.; Magnotti, F.; Morvillo, A. 2018. Collaborative innovation in tourism and hospitality: a systematic review of the literature. *International Journal of Contemporary Hospitality Management*, 30(6), 2364-2395.
- Mingaleva, Z.; Sheresheva, M.; Oborin, M.; Gvarliani, T. 2017. Networking of small cities to gain sustainability, *Entrepreneurship and Sustainability Issues* 140-156. [http://doi.org/10.9770/jesi.2017.5.1\(12\)](http://doi.org/10.9770/jesi.2017.5.1(12))
- Najda-Janoszka, M.; Kopera, S. 2014. Exploring barriers to innovation in tourism industry—the case of southern region of Poland. *Procedia-Social and Behavioral Sciences* 110: 190-201.
- Nelson, R.R. 1993. *National Innovation Systems: A Comparative Analysis*. Oxford: Oxford University Press: 292-342.
- Nybakk, E.; Hansen, E. 2008. Entrepreneurial attitude, innovation and performance among Norwegian nature-based tourism enterprises. *Forest Policy and Economics* 10(7-8): 473-479.
- Omerzel, D. G. 2015. Innovativeness in tourism: model development. *Procedia Economics and Finance* 2: 750-756.
- Panfiluk, E.; Szymańska, E. 2017. The measurement of the innovativeness of health tourism services using an adequacy matrix title of the article. *Entrepreneurship and Sustainability Issues* 4(4): 400-420. [https://doi.org/10.9770/jesi.2017.4.4\(1\)](https://doi.org/10.9770/jesi.2017.4.4(1))
- Postaliuk, M.P.; Andrianov, D.S.; Postaliuk, T.M. 2017. Management of the institutional system innovation as a factor for the sustainable development of the Russian economy. *Contemporary Economy Issues* 3 (63): 14-21. (In Russian).
- Prosser, R 1994. Social Change and the growth of tourism. In *Ecotourism: A Sustainable Option*: 19-37.
- Roberts, L.; Hall, D.; Morag, M. 2017. *New directions in rural tourism*. Routledge.
- Szymańska, E. 2015. Construction of the model of health tourism innovativeness. *Procedia-Social and Behavioral Sciences* 213: 1008-1014.
- Sheresheva, M. Y. 2018. The Russian tourism and hospitality market: new challenges and destinations. *Worldwide Hospitality and Tourism Themes*, 10(4): 400-411.
- Shevyakova, A.; Munsh, E.; Arystan, M. 2019. Information support for the development of tourism for the diversification of the economy of Kazakhstan. *Insights into Regional Development* 1(2): 138-154. [https://doi.org/10.9770/ird.2019.1.2\(4\)](https://doi.org/10.9770/ird.2019.1.2(4))
- Sundbo, J.; Orfila-Sintes, F.; Sørensen, F. 2007. The innovative behaviour of tourism firms—Comparative studies of Denmark and Spain. *Research Policy* 36(1): 88-106.
- Song, H.; Li, G.; Cao, Z. 2018. Tourism and Economic Globalization: an emerging research agenda. *Journal of Travel Research* 57(8): 999-1011.
- UNWTO. 2010. UNWTO Tourism Highlights. 2010 Edition. Retrieved from: <https://www.e-unwto.org/doi/pdf/10.18111/9789284413720> [10.04.2019].
- UNWTO. 2016. Terminology within Destination Management and Quality. Retrieved from: <http://cf.cdn.unwto.org/sites/all/files/docpdf/terminologydm.pdf> [15.04.2019].
- UNWTO. 2018. UNWTO Tourism Highlights. 2018 Edition. Retrieved from: <http://www2.unwto.org/content/why-tourism> [15.04.2019].
- van der Zee, E.; Vanneste, D. 2015. Tourism networks unravelled; a review of the literature on networks in tourism management studies. *Tourism Management Perspectives* 15: 46-56.
- Volo, S. 2012. A consumer-based measurement of tourism innovation. In *Innovation in hospitality and tourism*. Routledge: 85-100.
- von Friedrichs Grängsjö, Y. 2003. Destination networking: Co-opetition in peripheral surroundings. *International Journal of Physical Distribution & Logistics Management* 33(5): 427-448.
- Walsh, M.; Lynch, P.; Harrington, D. 2010. A Capability Based Framework for Tourism Innovativeness. Retrieved from: [https://repository.wit.ie/1552/1/A\\_Capability\\_Based\\_Framework\\_for\\_Tourism\\_Innovativeness.pdf](https://repository.wit.ie/1552/1/A_Capability_Based_Framework_for_Tourism_Innovativeness.pdf) [14.04.2019].
- Yang, L.; Wall, G. 2016. *Planning for ethnic tourism*. London: Routledge.

Zach, F. J.; Hill, T. L. 2017. Network, knowledge and relationship impacts on innovation in tourism destinations. *Tourism Management* 62: 196-207.

Zolotukhina, A.V. 2009. Innovative mechanism of external effects management in the conditions of the region's transition to sustainable development 2: 58-65.

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## CRYPTOCURRENCY AS DISRUPTIVE TECHNOLOGY: THEORETICAL INSIGHTS

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**Abstract.** Bitcoin, Cryptocurrencies and Blockchain technologies are widely discussed nowadays. The Bitcoin market value is discussed in top magazines, the names of people who earned money from cryptocurrencies are on the Richest People list. The Blockchain technology is said to be a one of disruption pioneers on the one hand, and cryptocurrency is said to be an illegal phenomenon on the other hand. The Fourth Industrial Revolution, which is based on digitalized industry is changing the power centres. Will cryptocurrency disrupt the financial sector? Or perhaps it will disrupt the retail market or global monetary policy. Disruptive technologies together with the Internet, Mobile Internet and Internet of Things are changing our world. While society has gained simple and reachable comfort for a cheaper price on the one hand, many people have lost their jobs on the other. Consequently, the authors presuppose discussion about the phenomenon of cryptocurrency through the context of social phenomena and legal regulation: divulge definitions, principles, relating to the topic; identify possible tendencies according to legal regulation and its practical realization.

**Keywords:** bitcoin; blockchain; cryptocurrency; disruptive technology; fourth industrial revolution; national security

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**JEL Classifications:** O33

**Additional disciplines** law; sociology

### 1. Introduction

The new cryptocurrency – Bitcoin made its first appearance with the publication of the white paper by the mysterious Satoshi Nakamoto (hereinafter – Nakamoto) in 2008. The Nakamoto payment model is based on “payments to be sent directly from one party to another without going through a financial institution” (Nakamoto 2008).

Initially Bitcoin seemed to be a game (in early 2008 and 2009). Not many looked at it seriously. Currently according to Kaplanov - “Bitcoin is the world’s first digital, private cryptocurrency exchanged over the internet through the use of a peer-to-peer network” (auth. – Blockchain). How has this happened? How did the game turn into a currency? (Kaplanov 2012).

Furthermore, the World Economic Forum identified Bitcoin-based Blockchain technology as among the top 10 emerging technologies, together, with the Internet of Nano things, Autonomous Vehicles, open Artificial Intelligence ecosystem (World Economic Forum 2016). It is therefore expected to increase its weight further for the global society.

The magic lies in its simplicity. The Bitcoin is based on Blockchain technology, which allows a transaction to be completed between parties without a financial institution intermediary. Simplicity is the magic that has turned Bitcoin from a game into powerful tool. Within ten years the number of Bitcoin users has increased dramatically. It had reached 1 mln. unique addresses at December 2017 (Blockchain Charts 2017). Total coin market capitalization was 71 billion USD in December 2018 and at the beginning of 2018 the level was 326 billion USD (Blockchain Charts 2018). In November 2017, it was ranked 30<sup>th</sup> of all currencies worldwide (Coinstaker 2017). The World Bank launched 110 mln. USD i-Bond stake, which is totally managed, using blockchain technology (World Bank 2018).

Standing on the threshold of the Fourth Industrial Revolution (4.0) Bitcoin might be one of its engines. During industrial revolution 4.0, technology drivers will have a profound impact on the nature of state relationships and international security, changing the character of security threats while also influencing shifts of power, which are occurring both geographically, and from state to non-state actors (Schwab 2016).

Christensen (2001) who invented the definition of disruptive technology (hereinafter – DT), states, “disruptive innovations were technologically straightforward; consisting of off-the-shelf components put together in a product architecture that was often simpler than previous approach methods”. Christensen states that disruptive innovation is – an innovation, employing a “technology” in management, marketing activities and investment policy which transforms information, labour, capital, and materials into products or services of greater value, which becomes the main goal of a company, and, as a consequence, fundamentally changes the established “rules of the game” in many industries. If a certain technology plays a critical role in a disruptive innovation, it could be defined as “disruptive technology” (DT) (Christensen, Bower, 1996). Christensen also states that DT should “Beat competitors with functionality” and “Beat competitors with speed, responsiveness and customization” (Christensen 2001). Nakamoto has raised both attributes in his white paper as a priority. He wrote, “payments to be sent directly from one party to another without going through a financial institution”. Glaser Folian et. al. defines that Bitcoin is used to “cheaply execute financial (cross-border) transactions”.

Bitcoin brings us a financial democracy which is often discussed as playing an important role for the shadow economy. According to Teivāns-Treinovskis (2016) it is “the economic processes which come into conflict with legal rules”. As the disruption of the technology can also have a negative impact, there is a lack of international consensus on Bitcoin as a threat for society.

There is no question that cryptocurrency will impact global and national economies; the only question is on what scale?. Despite the potential big impact on the global economy, cryptocurrency still does not have unified legal regulation. There are misleading national legal and political approaches towards cryptocurrencies. Will a country miss the opportunity for economy growth if it were not to accept cryptocurrency or would it bring unforeseen risks leaving the cryptocurrency market liberal and unregulated? From wide perspective, it is possible to discuss, that DT are factor, which influence the concept of national security in various vectors. With the changing global security situation, increase in external threats or emergence of new ones (cyberattacks, on-conventional warfare

models, etc.), countries must feel concern regarding consolidation of their security (Novikovas et al., 2017). Even the technological development of business sectors, such as energy or waste management, can be influencing argument for political decisions in the context of national security (Tvarovaničienė 2012; Tvaronavičienė 2016; Novikovas et al., 2019). The impact of changes, to security, based on DT, can occur in various aspects: for a specific business model, specifically for infrastructure or for a specific investment. The effect may be the creation of a new economic activity, existing modification or destruction. The strategy of security must ensure prevention, detection and response to possible treats in these aspects. The main challenge for governments is timely adoption law norms and principles, solving these problems (Limba et al., 2019).

The object of the paper– phenomenon of cryptocurrency as a currency, manifested in an unregulated, disruptive nature.

The aim of the paper – to reveal possible problematic features of cryptocurrency, as social phenomenon.

Methodology – document analysis, critical-analytical, systematic, linguistic, statistical data and comparative analysis methods were applied.

## **2. Background and Literature review**

### **2.1. Cryptocurrency brings disruption?**

Scientists also identify the potential of disruption in analysing cryptocurrencies. Baiyre et al. (2015) in their researches states that “Instead of trusting a single custodian, system-wide consensus is reached by an ever-growing proof of computational work. Arguably, this technology has the potential for disintermediation and disruption.”

Duggar et al. (2016) defines Blockchain technology as a key element for fast transactions, while Deloitte (2016) identifies technology, which is a source of democratic trust, as the system operates within it and is not controlled by external financial institutions.

According to Bucherer et al. (2012) “The purpose of an innovation process could be to change or improve products as well as entire business models”. Bitcoin has brought a Blockchain, which changes the process of the banking sector. It is changing the system as follows:

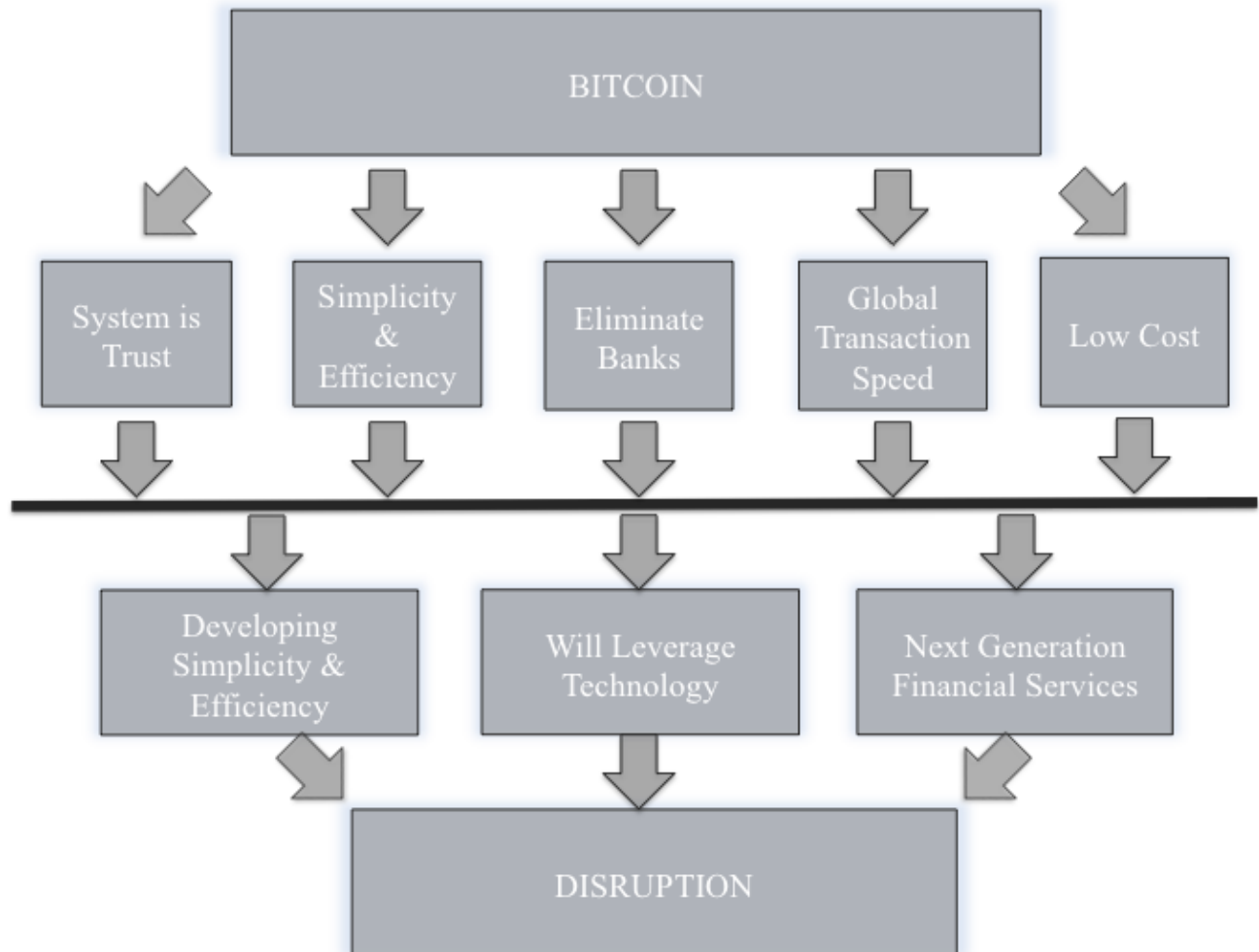
- Elimination of financial intermediary;
- Object of trust is a system instead of a financial institution;
- Speed of international transactions;
- Cost of transaction.

The World Economic Forum (2016) emphasized the potential of Blockchain, which Bitcoin is based on, stating that it might be the future of financial infrastructure. The World Economic Forum identifies the following value drivers of Blockchain technology:

- Potential to drive simplicity and efficiency;
- Will form the foundation of next generation financial services infrastructure;
- Can leverage the technology in different ways.



Analysts at Santander InnoVentures, have estimated that by 2022, Blockchain technology could save banks more than 20 USD billion annually in costs (World Economic Forum 2016).



**Chart No. 1.** Bitcoin Value Drivers Interaction with Disruption Technology Value drivers.

*Source:* Compiled by the authors.

The Chart No 1 above shows how Bitcoin value drivers interact with Disruption value drivers. Therefore, cryptocurrency as a possible object of disruption is highly expected. Currently, more than 2,000 cryptocurrencies are listed (Coinmarketcap, 2019).

## 2.2. Legal aspect

According to TFEU Article 3 "The Union shall establish an economic and monetary union whose currency is the euro."

For example, the national currency of all three Baltics states is the euro:

- By decision 2010/416/EU9 the Council decided that Estonia fulfilled the necessary conditions for adopting the euro.
- Council Decision of the EU (Further – CD) 2013/0190 (NLE) rules: "Latvia fulfils the necessary conditions for the adoption of the euro. The derogation in favour of Latvia referred to in Article 4 of the 2003 Act of Accession is abrogated with effect from 1 January 2014."
- According to Council Decision of the EU, (2014/509/EU) "Lithuania fulfils the necessary conditions for the adoption of the euro. The derogation in favour of Lithuania referred to in Article 4 of the 2003 Act of Accession is abrogated with effect from 1 January 2015".

It is however more problematic to discuss the status of cryptocurrency in these countries. On November 27, 2017, Estonia enacted amendments to its anti-money laundering legislation. According to § 3 "virtual currency" means a value represented in the digital form, which is digitally transferable, preservable or tradable and which natural persons or legal persons accept as a payment instrument, but that is not the legal tender of any country or funds for the purposes of Article 4(25) of Directive (EU) 2015/2366 of the European Parliament and of the Council on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, pp. 35–127) or a payment transaction for the purposes of points (k) and (l) of Article 3 of the same Directive. Furthermore, Estonian money laundering prevention acts foresee, that virtual currency service providers are required to have a license.

CNBC (2017) mentions that Estonia wanted to issue its own virtual currency. The cryptocurrency, called "estcoin," could be launched via the digital coin community's version of crowdfunding – an initial coin offering (ICO). However, the European Central Bank (ECB) has been highly critical of Estonia's plan (Perkinscoie 2018) and indicated that it would not allow any Member State to launch its own digital currency.

Latvian anti-money law regulation establishes: "virtual currency" – a digital representation of a value that may be digitally transmitted, stored or traded and function as an exchange medium but not recognized as a legal tender, shall not be considered a banknote and a coin, non-cash and electronic money, and shall not be monetary accrued in the payment instrument used in the cases referred to in Article 3 (10) and (11) of the Payment Services and Electronic Money Act; The same act reveals a definition of virtual currency service provider: "a person providing virtual currency services, including a provider of virtual currency exchange services issued by other persons, which allows users to exchange virtual currency for another virtual currency upon receiving a commission, or offers to buy and buy virtual currency through a recognized legal tender;"

The Bank of Lithuania stated that "financial services must be clearly dissociated from activities related with virtual currencies. Banks, payment institutions and other financial market participants should not provide services associated with virtual currencies or participate in their release". The Bank of Lithuania also mentioned that "although the implementation of the ICO is not regulated by specific legislation, nevertheless, taking into account, different ICO models and different features of the coins, the Bank of Lithuania seeks to draw the attention of ICOs and its distributors to the fact that in some cases this activity may be subject to obligatory requirements of Lithuanian law: depending on the nature of the offering, legal acts regulating crowdfunding, collective investment, provision of investment services, etc. must be applied.

Analysis of cryptocurrency in the Baltic States shows that none of the Baltic states regulate cryptocurrency as a currency, however, there have been initiatives to make an ICO at national level (Estonian Estcoin initiative) or

digital coin for collectors as was done by the Lithuanian bank. It is the opinion of the authors that cryptocurrency is more likely rhetorical – political initiatives rather than long-term strategies of the countries.

Lithuanian anti-money law regulation does not reveal a definition of cryptocurrency, but establishes a wide meaning term of *assets*: “objects, money, securities, other financial instruments, other assets and property rights, results of intellectual activity, information, actions and results of actions, other property and non-property values, as well as any other physical or non-physical, movable or immovable property, tangible or intangible assets and in any form, including electronic or digital, legal instruments or instruments proving ownership of or rights in such property.”

While cryptocurrency is becoming more popular, there is, however, no clear legal regulation, which helps to indicate a loophole. National police institutions reveal negative opinions. For example, Financial Crime Investigation Service under The Ministry of the Interior of the Republic of Lithuania states, that “The total turnover of major operations in the Lithuanian cryptographic market since the beginning of 2017 was about 660 million EUR. This market is often seen as decentralized and anonymous”.

### 3. Cryptocurrency = (non) currency

To define Cryptocurrency as a currency is very complicated. The opinions of scientists are many and they are divided. There are many definitions delivered from the point of view of mathematics, cryptographs and IT scientists. The number of definitions delivered from the management or legal point of view is relatively smaller. Following our analysis of the scientific bibliography we have established two different cryptocurrency definition approaches from the perspective of science:

- a) as a social phenomenon;
- b) as a legal situation

#### 3.1. Cryptocurrency as a social phenomenon

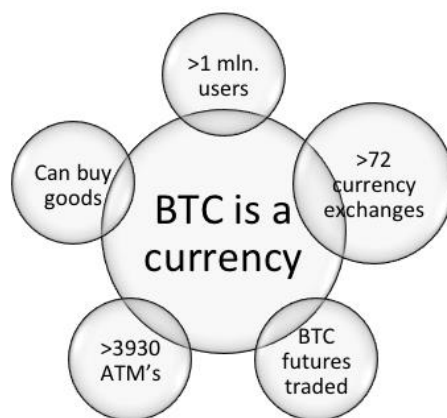
##### Scientists supporting Bitcoin as a currency

Paul Ehlog states that “currency is any agreed upon means of exchanges of goods and services, so you could have some small stones, as used in history, and if it’s accepted by a sufficiently large population” (Bloomberg 2014).

Scot Bret in his researches analysis Bitcoin as a cryptocurrency. He defines Bitcoin as “... a digital token that can be moved between parties”. In addition, Bret states, that “the token has market value in terms of major national currencies”. He also says, “it is sporadically used – albeit often in small amounts –in exchange for real world goods and services (Bret 2016).

Facts that support Bitcoin as a currency (Chart No 2):

- i) it is used by a wide range of people – > 1 mln. unique addresses (Blockchain Charts 2017).
- ii) it can be easily exchanged for goods.
- iii) it can be easily exchanged for different currencies throughout 72 exchanges worldwide (Bitcoin.org 2018).
- iv) it can be easily exchanged and withdrawn in small amounts throughout 3,930 ATM’s world-wide (Statista 2018).
- v) Bitcoin is traded on futures markets, including a few USA heavily regulated exchanges (CNBC 2018).



**Chart No 2.** Facts supporting Bitcoin as a currency

Source: Compiled by the Authors.

### *In between currency and non-currency*

According to “electronic money is a deposit of funds that is accessed electronically through a computer, a card or other device to pay for goods and services or debt” (Bishop 2012).

Riksbank defines virtual currency as digital money. “A virtual currency is a means of payment; that is, units of the virtual currency represent a value. It is intended for use in payments within a specific virtual community... This type of virtual community can thus be said to resemble a voluntary agreement to use a specific item as a means of payment.” (Riksbank 2017).

Kaplanov identifies a big number of currency signs, however finally he comes to a conclusion that Bitcoin is mostly a community currency. It should be noted, however, that since Kaplanov did his research, Bitcoin has evolved a lot (number of users, improved exchangeability, purchase of goods and Bitcoin futures). Taking into consideration that further cryptocurrency development is likely to proceed rapidly, Bitcoin would achieve more currency attributes.

One interesting fact disclosed by Broome et al. (2011) is that there is historical precedent of legitimisation of internationally unrecognized currencies. For example, in the early years of the United States, “the United States experimented with privately issued currency for a number of years”. “While state-chartered banks, which existed during the operations of the First and Second Banks (firsts attempts to create central banking – authors) of the United States, did issue private paper, the notes issued by the Banks of the United States were the predominant currency during the early years of the United States” (Broome et al. 2011). If there is historic precedent of a “predominant currency” in the US, we can theoretically assume that cryptocurrency might be transformed into another currency and become legitimate.

The European Banking Authority (EBA) and the European Central Bank (ECB) apply the term virtual currency (European Central Bank, 2012; European Banking Authority, 2013).

### 3.2. Is Bitcoin democracy a threat?

The main idea of Satoshi, the inventor of Bitcoin and the father of cryptocurrency is that cryptocurrency is not regulated by any institutions or legal intermediaries. The scientists who have analysed cryptocurrencies agree with this.

Grinberg (2012) in his research states “Bitcoin is a digital, decentralized, partially anonymous currency”. Mc Kinsey (2017) maintains the same position – “A blockchain is an encoded digital ledger that is stored on multiple computers in a public or private network.” Riksbank (2014) says “In a decentralised virtual currency scheme, like Bitcoin, the transactions are verified and executed via the network of users” as well as “The right to register activities is thus delegated to the network’s participants.”

Blundell-Wignall (2014) raises two main policy issues:

1. Lack of consumer protection (keeping value, theft prevention and arbitrage);
2. Anonymity brings socially unacceptable activities.

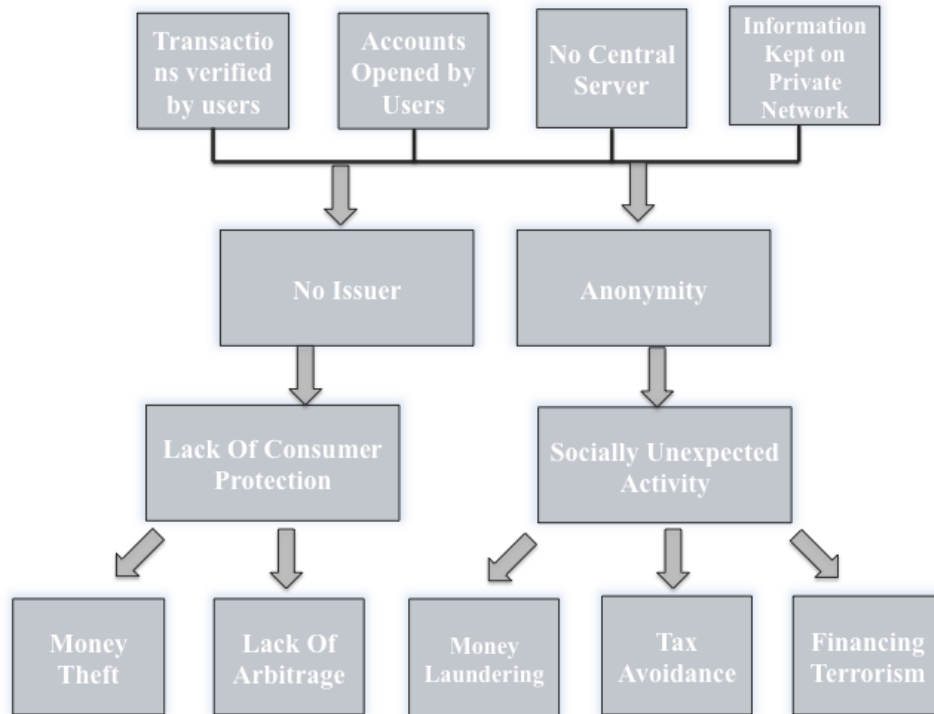
The main driver behind Anti Money Laundering (hereafter – AML) investment decisions are regulatory requirements, which oblige financial institutions and certain non-financial businesses to comply with AML legislation (KMPG 2014). There was however, no emittance of Bitcoin; therefore no one is obliged to adhere to AML procedures.

The analysis of the Basel Committee on Banking Supervision (2014) shows that the risk of unmonitored international money flow is increasing. “National borders nevertheless constitute a danger of being discovered, be it whether while smuggling large sums of cash through border controls or because of increasing reporting obligations of transnational capital flows.” The major disruptor of the increasing international money flows is considered to be cryptocurrencies.

The US Treasury’s Financial Crimes Enforcement Network identifies a three-step process of making “illegally-gained proceeds appear legal, by:

- 1) placing dirty money in the legitimate financial system;
- 2) layering it within additional transactions to obfuscate its origins;
- 3) integrating it into the financial system with more transactions so the funds appear legitimate.

In Chart No. 3. Potential threats from Bitcoin as a financial system are presented.



**Chart No. 3.** Potential threats from Bitcoin as a financial system.

Source: Compiled by the authors.

The uniqueness and democracy of Bitcoin brings high potential for money laundering. According to Masciandaro (1999) money laundering “shares two key-characteristics: illegality and concealment”. As mentioned in the US Treasury’s Financial Crimes Enforcement Network, money laundering needs a financial system. Therefore, the more legitimate Bitcoin becomes the greater the risk of money laundering for society.

Despite the different approaches of countries to the legitimization of Bitcoin, once Bitcoin is recognized as legitimate it will bring additional risk globally as a money laundering tool (infrastructure).

## Conclusion

According to the literature which analyses cryptocurrencies (including Bitcoin), the following attributes are common: a) there is no financial intermediary; b) transactions are instant; c) low cost; d) the system is an object of trust itself (replaces the financial institution). Therefore, these attributes lead to a more efficient and simpler financial system, having in mind cryptocurrency value drivers, which can leverage various technologies in different ways. It has formed the foundation for the next generation financial services. There is a consistent opinion in the Cryptocurrency and Disruptive Technology literature that cryptocurrency will lead to a disruption.

Reviewing the legal environment of cryptocurrencies in the Baltic countries, we conclude, that the boundary between cryptocurrency and virtual money is unclear: the definitions are identical in one case and in all others they are different. The authors of this article argue, that this is a consequence the lack of legal regulation. Lack of legal regulation can affect negative aspects. It can bring additional risks such as tax evasion, fraud activity or virtual currency, which can be used in the shadow economy. The European Commission has also issued an opinion indicating that there are plans to regulate cryptocurrency transactions, among which it proposes to distinguish between cryptocurrency and virtual money. The authors argue that this lack of definition is a loophole in the legal regulation.



Based on the analysis of the legislation of the Baltic states, it is possible to identify cryptocurrency regulatory initiatives, but those initiatives are more of a declarative nature: no clear position of parliaments; no clear definitions of what cryptocurrency is according to legal regulation; the nature of cryptocurrency is disclosed indirectly through anti-money laundering and regulation of the financing of terrorism.

As regards whether Bitcoin was the first cryptocurrency, we noted that it has the major attributes of a currency. From the historical point of view there were precedents when countries issued notes (non-recognized currencies), which after some time became legitimate. Therefore, we can conclude, that further development of Bitcoin or other cryptocurrency can theoretically be recognized as a currency.

While the new technology brings opportunities to the market, it also brings many threats. Democracy (system operates without a third party) and anonymity are the main factors that increase the risk of money laundering, terrorist attacks, tax avoidance and money theft. These factors together bring high risk for national security.

The scale and details of the regulation will determine the scope and scale of further cryptocurrency development as a disruption technology.

## References

- Baiyere, A. & Donnellan, B. & Hevner, A. & Smith, C., & Stikeleather, J. (2015). Disruptive Innovations and IT - Wicked yet Empowering combination. In: Proceedings Thirty Sixth International Conference on Information Systems. Available at: [https://pdfs.semanticscholar.org/b118/a9d1975093243a8db1061e0e2a0290486a53.pdf?\\_ga=2.41975010.679614516.1553350098-1846347052.1553350098](https://pdfs.semanticscholar.org/b118/a9d1975093243a8db1061e0e2a0290486a53.pdf?_ga=2.41975010.679614516.1553350098-1846347052.1553350098)
- Bank of Lithuania (2017). Bank of Lithuania announces its position on virtual currencies and ICO. Available at: <https://www.lb.lt/en/news/bank-of-lithuania-announces-its-position-on-virtual-currencies-and-ico>
- Bank of Lithuania (2017). Board of the Bank of Lithuania. 2017 October 10 meeting. (Protocol 01-32) Available at: <http://savadai.savadai.lt/document.php?id=15630&PHPSESSID=5c89a8a8fdbb0b25bdae76c93ba71e>
- Bank of Lithuania (2018). Lithuania's central bank to issue the world's first digital collector coin. Available at: <https://www.lb.lt/en/news/lithuania-s-central-bank-to-issue-the-world-s-first-digital-collector-coin>
- Brenig C. & Accorsi R, & Müller, G. (2015). Economic Analysis of Cryptocurrency Backed Money Laundering. Available at: [https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1019&context=ecis2015\\_cr](https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1019&context=ecis2015_cr)
- Bishop T. (2012). Money, Money, Banking and Monetary Policy. ISBN: 1105502627 P. 27-29
- Blockchain Charts (2017). Number Of Unique Addresses Used. Available at: <https://www.blockchain.com/charts/n-unique-addresses>
- Blockchain Charts (2018). Market Capitalization. Available at: <https://www.blockchain.com/charts/market-cap?timespan=2years>
- Bloomberg (2013). Bitcoins Fail Currency Test in Scandinavia's Richest Nation. Available at: <https://www.bloomberg.com/news/articles/2013-12-12/bitcoins-fail-real-money-test-in-scandinavia-s-wealthiest-nation>
- Blundell-Wignall A. (2014). The Bitcoin Question. Available at: <https://www.oecd.org/daf/fin/financial-markets/The-Bitcoin-Question-2014.pdf>
- Broome L.L. & Markham J.W. (2011). Regulation of Bank Financial Service Activities: Cases and Materials. ISBN 9780314266088 P. 9–11.
- Bucherer E. & Eisert U. & Gassmann O. (2012). Towards Systematic Business Model Innovation: Lessons from Product Innovation

Management. Creativity and Innovation Management 21. Available at:  
[https://s3.amazonaws.com/academia.edu.documents/39824425/Towards\\_Systematic\\_Business\\_Model\\_Innova20151109-30004-9v5ccw.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1553438244&Signature=XGaprleQ46gXaptyfFK1t%2Fo%2FHvA%3D&response-content-disposition=inline%3B%20filename%3DTowards\\_Systematic\\_Business\\_Model\\_Innova.pdf](https://s3.amazonaws.com/academia.edu.documents/39824425/Towards_Systematic_Business_Model_Innova20151109-30004-9v5ccw.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1553438244&Signature=XGaprleQ46gXaptyfFK1t%2Fo%2FHvA%3D&response-content-disposition=inline%3B%20filename%3DTowards_Systematic_Business_Model_Innova.pdf)

CoinMarketCap. (2019). All Crypto Currencies. Available at: <https://coinmarketcap.com/all/views/all/>

Council Decision of 13 July 2010 in accordance with Article 140(2) of the Treaty on the adoption by Estonia of the euro on 1 January 2011. (2011). Available at: <http://eurx.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:196:0024:0026:EN:PDF>

Council Decision of the EU (Further- CD) on the adoption by Latvia of the euro on 1 January 2014 2013/0190 (NLE) Article 1. (2013). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013PC0345&from=en>

Council Decision of the EU, of 23 July 2014 on the adoption by Lithuania of the Euro on 1 January 2015. (2014/509/EU). (2014). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0509&from=LT>

Digital Currencies: International Actions and Regulations (2018). Perkins Coie. Available at: <https://www.perkinscoie.com/en/news-insights/digital-currencies-international-actions-and-regulations.html#Estonia>

Deloitte (2016). Blockchain: Democratized trust. Innovation in the digital era, Deloitte University Press. Available at: <https://www2.deloitte.com/insights/us/en/focus/tech-trends/2016/blockchain-applications-and-trust-in-a-global-economy.html>

Duggar E. H &. Bauer G. W. & Williams R. & Caes N., (2016). Robust Cost-effective Applications Key to Unlocking Blockchain's Potential Credit Benefits, Moody's Investors Service, Moody's. Available at: <https://www.scribd.com/document/319012770/Robust-Cost-effective-Applications-Key-to-Unlocking-Blockchain-s-Potential-Credit-Benefits>

Bitcoin.org (2018). Bitcoin Exchanges. Available at: <https://bitcoin.org/en/exchanges#australia>

Brett S. (2016). How can cryptocurrency and blockchain technology play a role in building social and solidarity finance? United Nations Research Institute for Social Development (UNRISD), Geneva. Available at: <http://www.unrisd.org/brett-scott>

Christensen C. M. (2001). The Opportunity and Threat of Disruptive Technologies. Harvard Business School. Available at: <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/S0883769400020571>

CNBC (2018). For brave investors there's two ways to bet on bitcoin. Available at: <https://www.cnn.com/2018/06/11/the-big-bitcoin-investing-decision-coin-or-futures-contract.html>

CNBC (2017). Estonia wants to launch its own government-backed cryptocurrency called 'estcoin' (2017). CNBC. Available at: <https://www.cnn.com/2017/08/23/estonia-cryptocurrency-called-estcoin.html>

Coinstaker.com (2017). Bitcoin Becomes World's 30th Largest Currency. Available at: <https://www.coinstaker.com/bitcoin-becomes-worlds-30th-largest-currency>

European Central Bank (2019). Electronic Money. Available at: [https://www.ecb.europa.eu/stats/money\\_credit\\_banking/electronic\\_money/html/index.en.html](https://www.ecb.europa.eu/stats/money_credit_banking/electronic_money/html/index.en.html)

Financial Crime Investigation Service. (2018). FNTT su kitais teisės saugos atstovais aptarė virtualių valiutų keliamą pavojų valstybei. Available at: <http://fntt.lt/lt/naujienos/fntt-su-kitais-teisesaugos-atstovais-aptare-virtualiu-valiutu-keliama-pavoju-valstybei/3676>

Grinberg R. (2012). Bitcoin: An Innovative Alternative Digital Currency. Hastings Science and Technology Law Journal. Available at: [https://repository.uchastings.edu/cgi/viewcontent.cgi?article=1063&context=hastings\\_sci\\_tech\\_law\\_journal&redir=1&referer=https%253A%252F%252Fscholar.google.lt%252Fscholar%253Fhl%253Dlt%2526as\\_sdt%253D0%25252C5%2526q%253Dbitcoin%252Bas%252Bdigital%252Bcurrency%2526btnG%253D#search=%22bitcoin%20as%20digital%20currency%22](https://repository.uchastings.edu/cgi/viewcontent.cgi?article=1063&context=hastings_sci_tech_law_journal&redir=1&referer=https%253A%252F%252Fscholar.google.lt%252Fscholar%253Fhl%253Dlt%2526as_sdt%253D0%25252C5%2526q%253Dbitcoin%252Bas%252Bdigital%252Bcurrency%2526btnG%253D#search=%22bitcoin%20as%20digital%20currency%22)

Glaser F., & Zimmermann K., & Haferkorn M. & Weber M. C. & Siering M. (2014). Bitcoin – Asset or Currency? Revealing Users' Hidden Intentions. Available at: <http://ssrn.com/abstract=2425247>

Kaplanov N. M. (2012). Nerdy Money: Bitcoin, the Private Digital Currency, and the Case Against its Regulation. Available at: [https://lawcommons.luc.edu/cgi/viewcontent.cgi?referer=https://scholar.google.lt/scholar?hl=lt&as\\_sdt=0%2C5&q=Kaplanov+bitcoin&btnG=&httpsredir=1&article=1920&context=lcir](https://lawcommons.luc.edu/cgi/viewcontent.cgi?referer=https://scholar.google.lt/scholar?hl=lt&as_sdt=0%2C5&q=Kaplanov+bitcoin&btnG=&httpsredir=1&article=1920&context=lcir)

KPMG (2014). Global Anti-Money Laundering Survey. Available at: <http://www.kpmg.com/KY/en/IssuesAndInsights/ArticlesPublications/PublishingImages/global-anti-money-laundering-survey-v3.pdf>

Latvijas Vestnesis (2017). Amendments to the Law on Prevention of Money Laundering and Terrorist Financing, No. 222 (6049) of Nov. 8, 2017, Official Gazette No. 2017/222.7. Available at: <https://www.vestnesis.lv/op/2017/222.7>

Lietuvos Respublikos Seimas (1997). Law on the Prevention of Money Laundering and Terrorist Financing of the Republic of Lithuania. Official gazette 1997-07-04, Nr. 64-1502. Available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.41300/WFwjVAGMlz>

Limba T. & Stankevičius A. & Andrulevičius A. (2019). Industry 4.0 and national security: the phenomenon of disruptive technology, Entrepreneurship and Sustainability Issues 6(3): 1528-1535. Available at: [https://doi.org/10.9770/jesi.2019.6.3\(33\)](https://doi.org/10.9770/jesi.2019.6.3(33))

Masciandaro D. (1999). "Money Laundering: the Economics of Regulation." European Journal of Law and Economics 7. Available at: [http://www.urosario.edu.co/observatorio-de-lavado-de-activos/imagenes/Masciandaro-\(1999\).pdf](http://www.urosario.edu.co/observatorio-de-lavado-de-activos/imagenes/Masciandaro-(1999).pdf)

McKinsey (2017). Using blockchain to improve data management in the public sector. Available at: <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector>

Money Laundering and Terrorist Financing Prevention Act (2017). Riigi Teataja Available at: <https://www.riigiteataja.ee/en/eli/517112017003/consolide>

Nakamoto S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. Available at: <https://bitcoin.org/bitcoin.pdf>.

Novikovas, A. & Novikovienė, L. & Shapoval, R. & Solntseva, K. (2017). The peculiarities of motivation and organization of civil defence service in Lithuania and Ukraine. Journal of Security and Sustainability Issues, 7(2), 369-380. Available at [http://dx.doi.org/10.9770/jssi.2017.7.2\(16\)](http://dx.doi.org/10.9770/jssi.2017.7.2(16))

Novikovas, A. & Stankevičius, A. (2018). Municipal waste, as critical infrastructure, management: case of Lithuania, Journal Security and Sustainability Issues, 8(2): 257–265. Available at: [http://doi.org/10.9770/jssi.2018.8.2\(12\)](http://doi.org/10.9770/jssi.2018.8.2(12))

Statista (2016). Number of Bitcoin ATMs worldwide from January 2016 to November 2018. Available at: <https://www.statista.com/statistics/343127/number-bitcoin-atms>

Schwab, K. (2016). The Fourth Industrial Revolution. Geneva: World Economic Forum. ISBN 1944835008.

Sveriges Riksbank (2017). Available at: <https://www.riksbank.se/globalassets/media/rapporter/pov/filer-fore-2017/artiklar/rappovartikel41400918eng.pdf>

Sveriges Riksbank. (2014) Have virtual currencies affected the retail payments market? Economic commentaries No 2. Available at: [http://archive.riksbank.se/Documents/Rapporter/Ekonomiska\\_kommentarer/2014/rap\\_ek\\_kom\\_nr\\_02\\_140617\\_eng.pdf](http://archive.riksbank.se/Documents/Rapporter/Ekonomiska_kommentarer/2014/rap_ek_kom_nr_02_140617_eng.pdf)

Swan M. (2015). Blockchain: Blueprint for a New Economy. O'Reilly Media, Inc. ISBN-10: 9781491920497 P. 11.

Teivāns-Treinovskis J. & Amosova, J. 2016. Some aspects of criminal environment impact on sustainable entrepreneurship activities, Entrepreneurship and Sustainability Issues 4(1): 17-24. [http://dx.doi.org/10.9770/jesi.2016.4.1\(2\)](http://dx.doi.org/10.9770/jesi.2016.4.1(2))

The World Bank (2018). World Bank Prices First Global Blockchain Bond, Raising A\$110 Million. Available at: <https://www.worldbank.org/en/news/press-release/2018/08/23/world-bank-prices-first-global-blockchain-bond-raising-a-110-million>

Treaty on the Functioning of the European Union, Article 3 (2012). Official Journal of the European Union C 202. Available at <https://www.ecb.europa.eu/>

Tvaronavičienė, M. (2012). Contemporary perceptions of energy security: policy implications, Journal of Security and Sustainability Issues 1(4): 235–247. [http://dx.doi.org/10.9770/jssi.2012.1.4\(1\)](http://dx.doi.org/10.9770/jssi.2012.1.4(1))

Tvaronavičienė, M. (2016). Entrepreneurship and energy consumption patterns: case of households in selected countries, Entrepreneurship

and Sustainability Issues 4(1): 74-82. [https://doi.org/10.9770/jesi.2016.4.1\(7\)](https://doi.org/10.9770/jesi.2016.4.1(7))

World Economic Forum (2016). Blockchain: what it is, how it really can change the world. Available at: <https://www.weforum.org/agenda/2016/06/the-blockchain>

World Economic Forum (2016). These are the top 10 emerging technologies of 2016. Available at: <https://www.weforum.org/agenda/2016/06/top-10-emerging-technologies-2016>

World Economic Forum (2016). The future of financial infrastructure, World Economic Forum. Available at: <https://www.weforum.org/reports/the-future-of-financial-infrastructure-an-ambitious-look-at-how-blockchain-can-reshape-financial-services>

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## INFORMATION SECURITY MANAGEMENT IN SMES: FACTORS OF SUCCESS

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**Abstract.** While the consecutive metamorphoses in the world economy changes the paradigm of doing business, the sources of success of almost every type of business transfer from tangible to intangible assets, and the information and its value becomes more and more significant, especially in the segment of small and medium sized enterprises. The aim of this paper was to identify the factors of success of information security management in segment of SMEs in Slovakia. Based on the literature research we identified 4 main factors of success of information security management, including the Compliance of information security management with the company's business activities, Support of top management, Security controls and Organizational awareness. To identify the importance and interconnections of the specified factors we have addressed senior IT security experts from SMEs in Slovakia. The experts evaluated the significance and relationships the factors of success of information security management and the results of the expert evaluation were processed using the DEMATEL technique. The results of the research show that the Security Controls and Supportive top management are the most important factors in general, while the factor of organizational awareness is the most obvious and important in the short-term period. Our results imply that SMEs should promote organizational awareness in information security management in line with implementation of the security controls at the first line of the defense.

**Keywords:** information security management; DEMATEL; support of top management; security controls; organizational awareness

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### 1. Introduction

While the consecutive metamorphoses in the world economy changes the paradigm of doing business, the sources of success of almost every type of business transfer from tangible to intangible assets, and the information and its value becomes more and more significant. Belan (2015) state that information becomes the most important competitive assets of the company and that information becomes a high market value goods. Khouri (2009) confirms that information is one of the most important assets that organizations have, and therefore, it needs the protection which is adequate to its value.

Sklenár and Čimová (2018) declare that however, the progress in the development of the digital economy is crucial for the improvement of the competitiveness of the EU economy, the use of ICT is also highly associated with threats. Information currently became a potential target for threats and needs to be protected. While information itself is a type of intangible capital its value is not easy to assess. However, traditional performance measurement methods focus on known financial measures, they are not satisfactory to describe and manage intangible information assets (Huang et al., 2006). Polkowski and Dysarz (2017) note that the interest in aspects of information security management for researchers, traders and users is increasing.

It is generally known that small and medium-sized enterprises (SMEs) are one of the most important and valuable part of the world economy (Badulescu, 2010; Karpak and Topcu, 2010; Maciejewski and Wach, 2019), and as the most important engine of an economic growth (Henderson and Weiler, 2010). 99 % of all companies in the USA and the European Union belong to a category of SMEs (Bhaird, 2010; Peracek et al., 2018). Slovak economy, where our research takes place, is not an exception. The share of SMEs in this country reaches 99.9 % of the total number of enterprises, their share of the state's value added is about 53 % (Slovak business agency, 2015). According to the same data source SMEs employ more than 72% of labor force in this country.

However, Verbano and Venturini (2013) insist that all enterprises need to adopt risk management strategy and methodology to identify, assess and treat risks to survive on the market, only large enterprises do usually have a well-developed risk management and are applying risk limiting instruments, while SMEs do not often know that these instruments even exist (Belás et al., 2014). The research in the field of risk management by Adásková (2009) confirmed that 76% of SMEs usually address the risk via an intuitive approach, and only 36.5% of them uses risk management systems. While SMEs belong to the most vulnerable business segment, underestimation of the risks in the field of information security management may be crucial for these enterprises.

The aim of this paper is to identify the factors of success of information security management in segment of SMEs in Slovakia. The paper has the following structure. The first chapter brings the results of the literature research on the topic of information security management. The second chapter presents the applied methodology together with the description of the key factors of information security management. The third chapter presents the results of the case study, and the last chapter brings a short discussion and conclusion of the study.

## **2. Literature review**

Information security is one of the key areas of organizational security management. Security Management is a field of management that addresses the security of assets in an enterprise. According to Khouri (2009), information security means the protection of information during its creation, processing, storage, transmission and disposal, through logical, technical, physical and organizational measures that counteract the loss of confidentiality, integrity and availability. Information security management is according to ISO / IEC 2000: IT service management a "set of tools and measures ensuring the security of information and their flows in the company".

Information Security Management is a part of the overall organization management system, the foundation for managing security risks, the goal of which is to establish, implement, operate, monitor, review, maintain and improve information security in the organization (Rajnoha et al., 2017; Radu, 2018; Davidekova et al. 2016; Lengyel et al., 2017; Tvaronavičienė, 2018; Davidavičienė et al., 2019).



According to the same authors the organization's management should establish a clear information security policy orientation in line with the organization's objectives and demonstrate support for, and commitment to, information security through the publication and maintenance of an information security policy across the organization.

Hudec (2014), Gródek-Szotak and Nesterak (2017) or Korenkova et al. (2019) declare that the information security policy document should be approved by the management of the organization and should contain opinions on the definition of information security, its overall purpose and scope, its importance as a mechanism for sharing information.

According to Dekýš (2010), small and medium-sized enterprises form a specific environment in terms of enforcement and information security management. The differences with large companies are as follows (Dekýš, 2010): *non-existing or just a minimal security team; missing budget for information security, or a budget as a part of the general IT budget; lower range of financial, time and human resources allocated to information security; use of the open-source projects to minimize ITC expenditures; security management performed by the IT department.*

According to Millaire et al. (2017), Mandorf and Gregus (2014), Zavadska and Zavadsky (2018) a fundamental reason why SMEs are a popular target for threats is that attackers are looking for simple goals and small companies with limited budgets and don't consider cyber security to be important. SMEs they are easier to disrupt than large enterprises that invest substantial amount of funds in the security of information systems (Millaire et al., 2017).

Hau et al. (2016) note that most companies do not know for months that they have been attacked. According to FireEye (2016), most companies were not able to identify for months that they were attacked (469 days on average since the incident after detection). FireEye (2016) also stated that while the media mostly present the information about the data breaches of the giant corporations, as many as 77% of cybercrime is actually targeting SMEs.

Most cyberattacks on small and medium-sized enterprises (SMEs) are the result of a bad password (Ashford, 2017). Some password management suggestions are also presented by Chmielarz and Zborowski (2017).

For the successful implementation of security policy, critical factors need to be identified and the level of importance of each one assessed. The study by Lopesa and Oliveira (2015) or Vilcekova et al. (2018) contributes to the identification of these factors by presenting the results of a survey of security of information systems in SMEs. The aim of the study by Tu and Yuan (2014) was to identify the factors of successful implementation of information security management in an enterprise. Based on the twenty most relevant and recent studies, they identified ten factors that may be considered important in implementing information security management. The most important factors in determining the successful implementation of information security management are *employee awareness and training*, as well as the *support for senior management*. The importance assessment for both specified factors is almost the same.

Tu, et al. and (2018) and Olah et al. (2019) focused the study on identifying and modeling factors that contribute to the success of information security management. They identified six critical success factors. The authors concluded that, through business alignment, organizational support, IT competencies and organizational awareness of security risks and controls, information security controls can be effectively developed, leading to the success of information security management. Each of these factors affects information security, while the complex solutions include combinations of all of them.

Zamman and Razali (2016) identified three aspects of information security management success factors based on expert opinions – people, process and organization. Waly, Tassabehji and Kamala (2012) concluded that information security can be managed through three separate mechanisms: organizational factors, behavioral factors and education.

In the paper by Kazemi et al. (2012), the authors identified the following factors for the success of the implementation of information security management: support for senior management, information security policy, labor responsibility, employee motivation, awareness and training programs, information security compliance, international standards, and the use of information security services by external consultants.

Alnatheera (2015) identified the following factors of successful information security management - promoting top management for information security, creating an effective information security policy, information security and training and organizational culture. Alnatheera (2015) also stated that ethical norms and policies may vary from country to country.

Based on the previous literature review we have decided to narrow down the scope of our research and focus on 4 main factors of success of information security management, defined by most of the authors as the most important: *Compliance of information security management with the company's business activities (F1)*, *Support of top management (F2)*, *Security controls (F3)* and *Organizational awareness (F4)*. All factors are also expressed in the ISO 27001 standard.

Focus on the *factor F1* can be defined as follows. Business compliance and business strategy with information security management strategy are consistency in addressing needs, requirements, goals, and information security management structures. An effective strategy must ensure and protect information assets while enabling business. Experts have pointed out that protecting information resources from potential threats should be part of a business strategy as it can provide a competitive advantage to a business (Soomro et al., 2016). Information security objectives and activities must be consistent with business objectives and requirements and be managed by business management (Kayworth and Whitten, 2010; Ma et al., 2009). There must be close collaboration between information security managers and business managers.

Information security management practices must be consistent with the organization's business strategies (Chang et al., 2011). The aim of reconciling information security with the business strategy is to support business objectives in the business sector (Herath et al., 2010). Security management must be business-driven and based on business goals, values or needs (Spears and Barki, 2010).

The role of the *second factor F2* may be justified by the following findings of the experts in the field. Soomro et al. (2016) emphasize the role of management in information security management. Management must actively support information security efforts at all levels. Top management engagement can in many ways support information security - from funding and human resource allocation to highlighting the importance of security for other business components (Kayworth and Whitten, 2010).

Kazemi et al. (2012) consider supporting top management as an important factor in the success of information security management. Whitman and Mattord (2012) argue that providing information security is the responsibility of the top management. Promoting top management is very important for successful information security management (Kayworth and Whitten, 2010; Ma et al., 2009; Ma et al. 2009; Tu and Yuan (2014). In addition, top management plays the most important role in creating effective organizational structures, as organizational structure is very important to information security management.

The role of the *factor F3* refers to technical and procedural information security controls, including risk management, security policies and application of standards. Organizations need to implement security controls and use them to protect information security. Security policies and countermeasures can protect information systems from security risks. Tu, et al. and (2018). Tu and Yuan (2014) identified the following crucial processes for developing security controls: *risk management, security policy implementation, and compliance*. Risk management is considered the most effective approach to identifying the most effective set of security controls. Security policies are an example of organizational solutions to security problems - they are countermeasures and strategies taken to reduce systemic risks. If an enterprise wants to successfully implement information security management, the relevant standards must be followed (Yildirim et al., 2011).

*The factor F4* refers to workers' knowledge of information security risks, policies and related practices. In a broader sense, this also includes an information security culture, that is the way in which people rely on information security in the enterprise. Employees should have adequate literacy in case of information technology. IT literacy provides the basis for key security concepts (Culnan et al., 2008). Waly, Tassabehji and Kamala (2012) emphasize the need for education. Thus, training can increase employee awareness, understanding and participation in information protection (Ma et al., 2009). It is of the utmost importance that the company supports standards and procedures for building information security, says Tu and Yuan (2014). Information security policy will not be effective without training (Soomro et al., 2016). Empirical evidence suggests that it is difficult to implement security controls if people do not have sufficient training on best IT security practices (Werlinger et al., 2009).

### 3. Aim and methodology

The aim of this paper is to identify the factors of success of information security management in segment of SMEs. The research is geographically focused on Slovakia. At the base of the literature research of the most important information security management success factors the research team narrowed the scope of the research at four main factors: *Compliance of information security management with the company's business activities (F1), Support of top management (F2), Security controls (F3) and Organizational awareness (F4)*.

The research team formulated the following scientific hypotheses:

H1: Four main factors (F1 to F4) of information security management are equally important.

H2: The cause and effect relationship among the factors of information security management (F1, F2, F3 and F4) does not exist.

In small organizations, responsibility for safety management is concentrated at the level of the statutory body, as it is not effective to employ a dedicated full-time security manager. Another solution is to accumulate functions within an enterprise or outsource an information security manager (CISO). The questionnaire research in the field of information security management of SMEs is quite problematic. Kotulic and Clark (2004) conducted a survey related to information security management in the USA and found that as many as 23 percent of the respondents who refused to answer the questions in the questionnaire declared that they are not eager to share any information about their computer security policies with outside entities.

Facing the risk of getting unreliable data from not sufficiently experienced respondents the research team decided to conduct the research with the use of the structured expert evaluation method applied on a selected group of senior IT security experts accompanied by the use of appropriated sophisticated statistical tools. We have

addressed ten senior information security management experts from the insurance and banking sectors in Slovakia and asked them to respond to our questions. None of the contacted experts refused to cooperate. This number of experts is sufficient for the method of structured expert evaluation since the usual number of experts for the DEMATEL technique is around six – the quantity if replaced by the quality and preciseness in this case (Lo and Chen, 2012, Tianshui and Gang, 2014, Hu and Chen, 2016). The questions in the survey were formulated in a way that allowed to evaluate the answers using the DEMATEL technique. The experts evaluated the significance of four factors from the view point of success of information security management. When making expert estimates, the experts were asked to address the issue of information security management in a specific area, namely in case of SMEs. The results of the expert evaluation were processed using the DEMATEL technique.

The DEMATEL technique (Decision making trial and evaluation laboratory) is considered to be an effective method for identifying the components of the cause and effect chain of a complex system. This technique deals with evaluating interdependent relationships between factors and identifying critical factors through a structural model with the use of a digraph to illustrate relationships.

Lo and Chen (2012) proposed a hybrid procedure for assessing the level of information security in various security controls using the DEMATEL technique. Tianshui and Gang (2014) have proposed a new security and privacy assessment model for the information system. Hu and Chen (2016) identify important security factors for e-government cloud computing using DEMATEL.

DEMATEL was developed at the Geneva Research Center at the Battelle Memorial Institute (Tan and Kuo, 2014).

While considering the number of  $n$  factors  $F_1, F_2, \dots, F_n$ , in a first step the experts  $E_1, E_2, \dots, E_m$  are invited to quantify the direct effect of factor  $F_i$  on factor  $F_j$  ( $i, j = 1, 2, \dots, n; i \neq j$ ). The experts evaluate the significance of factors using the "no impact (0)", "low impact (1)", "medium impact (2)", "high impact (3)" and "very high impact (4)" scales.

We designed individual direct-influence matrices from the expert evaluations. By aggregating expert opinions, we got a group direct-influence matrix:

$$Z = (z_{ij}); z_{ij} = \frac{1}{m} \sum_{k=1}^m z_{ij}^k; i, j = 1, 2, \dots, n.$$

The normalized direct-influence matrix is obtained using the following transformation:

$$X = \frac{1}{s} Z; s = \max \left\{ \max_{1 \leq i \leq n} \sum_{j=1}^n z_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n z_{ij} \right\}.$$

Using the normalized matrix of direct influence, we calculated the total influence matrix  $T = (t_{ij})$  by adding all the direct effects and all indirect effects

$$T = X + X^2 + \dots + X^h = X(I - X)^{-1}, \text{ for } h \rightarrow \infty,$$

where  $I$  is a unit matrix.

In the next step, we constructed an influential relation map (IRM). Let  $R$  be the vector of the sums of the individual columns and  $C$  is the vector of the sums of the individual columns of the matrix  $T$ . Then

$$R = (r_i) = (\sum_{j=1}^n t_{ij}) ; i = 1, \dots, n$$

and

$$C = (c_j) = (\sum_{i=1}^n t_{ij}) ; j = 1, \dots, n.$$

Values  $r_i ; i = 1, \dots, n$ , represent the sum of the direct and indirect effects that depend on factor  $F_i$  towards other factors.

Values  $c_j ; j = 1, \dots, n$  represent the sum of the direct and indirect effects that factor  $F_j$  receives from other factors.

Values  $r_i + c_i ; i = 1, \dots, n$  represents degree of central role. The higher the centrality degree is, the more important the factor is.

Values  $r_i - c_i ; i = 1, \dots, n$  shows the degree of relation. Relation divide the criteria in to cause and effect group. If  $r_i - c_i$  is positive then factor  $F_i$  belongs to cause group. If  $r_i - c_i$  is negative then factor  $F_i$  belongs to effect group.

The representation of the values  $(R + C, R - C)$  in the graph gives us valuable information for the decision making. Factors in quadrant I are identified as major factors. They have a high degree of importance and important relationships. Factors in quadrant II are identified as driving factors because they are of little importance but a high degree of relationships. Factors in quadrant III have little importance and little degree of relationships. They are relatively disconnected from the system. Factors in quadrant IV are of high importance, and low degree of relationships; so-called impact factors. They are influenced by other factors. They cannot be directly improved.

In many articles there is a threshold value used. It allows to filter out negligible effects. We determined the threshold value as the maximum value of the diagonal elements of the matrix  $T$  (Tan and Kuo, 2014).

We calculate the weight of importance of the  $i$  - th criterion from the relationship

$$w_i = \frac{r_i + c_i}{\sum_{i=1}^n (r_i + c_i)} ; i = 1, 2, \dots, n.$$

#### 4. Results and Discussion

The following matrices present the results of the DEMATEL technique application. A group direct-influence matrix  $Z$ , normalized group direct-influence matrix  $X$  and total influence matrix  $T$  are as follows

$$Z = \begin{pmatrix} 0 & 3.1 & 1.9 & 3.2 \\ 3.6 & 0 & 3.9 & 3.8 \\ 2.9 & 3.0 & 0 & 3.6 \\ 2.2 & 2.0 & 3.3 & 0 \end{pmatrix}, \quad X = \begin{pmatrix} 0 & 0.27 & 0.17 & 0.28 \\ 0.32 & 0 & 0.35 & 0.34 \\ 0.26 & 0.27 & 0 & 0.32 \\ 0.19 & 0.18 & 0.29 & 0 \end{pmatrix},$$

$$T = \begin{pmatrix} 0.75 & 0.92 & 0.94 & 1.10 \\ 1.21 & 0.91 & 1.27 & 1.39 \\ 1.04 & 1.00 & 0.88 & 1.23 \\ 0.86 & 0.81 & 0.96 & 0.82 \end{pmatrix}.$$

The threshold value 0.91 was chosen as the maximum value of the diagonal of the total influence matrix  $T$ .

**Table 1.** Total relation matrix and the causal influence levels

	F1	F2	F3	F4	R	C+R	R-C
F1	0	0,92	0,94	1,1	2,96	5,21	0,71
F2	1,21	0	1,27	1,39	3,87	5,79	1,94
F3	1,04	1	0	1,23	3,27	6,44	0,12
F4	0	0	0,96	0	0,96	4,68	-2,77
C	2,25	1,92	3,17	3,72			

Source: Own calculations

Note: F1 – Compliance; F2 - Top Management; F3 - Security Controls; F4 – Awareness.

The importance of the four factors is prioritized based on  $(r + c)$  values. It is evident from Table 1 that the most important factor within the causal relation is F3 (Security Controls) with the largest  $(r + c)$  value 6,44 and factor F2 (Top Management) with the  $(r + c)$  of 5,79, followed by the F1 (Compliance) with the value of 5,21. The factor F4 (Awareness) is a little less important with the value of 4,68. *The hypothesis H1 was rejected* – the importance of the selected factors F1 to F4 is not equal. In case of the limited budget on information security management, SME should focus the attention on the *Security controls* at the first place.

The centrality degree represents the strength of the effect on success of information security management. The results of the research identified that the *Security Controls* is the most important factor of success of information security management. The results of technical and procedural information security controls, risk management and application of standards reflect the success of information security management. The second most important factor is the *supportive top management*. Top management really plays the most important role in the company in the field of information security. This result is in line with the articles that highlight the importance of top-management support. Information security management must be consistent with the company's business activities. They must not prevent them but help them. Therefore, the importance of the compliance with information security management with business activities of the company is considered as relevant. Several studies have also confirmed the importance of organizational awareness.

The weight of the factors corresponds with significance is presented in the Figure 1.



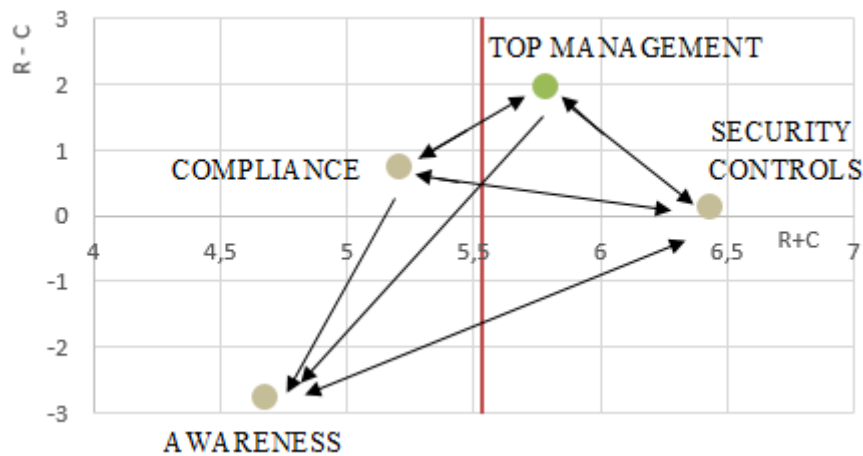


**Figure 1.** The weight of the factors  
Source: Own calculations

Based on the (r-c) values, the specified four factors were divided into the cause group (4) and the effect group (1). The positive value of (r-c) of the factor classified it to the cause group that directly affected the others. The highest (r-c) valued factors also had the greatest direct impact on the others. The factors F2 (1,94), F1 (0,71) and F3 (0,12) belong to cause group in our case study.

The negative value of the (r-c) of the factor meant that this factor is largely influenced by the others and classified it to the effect group. In case of our research the factor F4 was categorized in the effect group, with the (r-c) value equal to -2,7. *Organizational awareness (F4)* was the affected the most by *Compliance of information security management with the company's business activities (F1)*, *Support of top management (F2)*, *Security controls (F3)*. These results allow us to reject the *hypothesis H2* – factors F1, F2 and F3 do affect the factor F1.

From the total relation matrix *T* we will construct an impact-relation map for the success of information security management.



**Figure 1.** The cause and effect diagram (Influential relation map IRM)  
Source: Own calculations

The reasoning factors, that are affecting the others, are the most fundamental. These factors not only promote the information security management directly, but also influence the other factors. They are the key factors to establish the long-effect mechanism of the successful security management system. The importance of the top management of the company can hardly be under evaluated since the top management directly influences all the processes inside the company. In spite of the fact, that the factor F2 (the supportive top management) was

identified as the second most important factor, our results also confirmed that the influence of this factor on the other ones is the highest. The effect of the other two factors – compliance of information security management with business activities of the company and security controls – is weaker, but still significant. Any pair of the three factors *Compliance of information security management with the company's business activities (F1)*, *Support of top management (F2)*, *Security controls (F3)* are mutually influenced by each other.

The result factors are the most direct factors to promote the information security management in the company, but they can be easily influenced by the other factors. Due to this fact our results imply that the factor of organizational awareness (F4) is the most obvious and important factor for the success of information security management in the short term.

Supportive top management especially in area of education, training, increasing IT literacy skills will certainly help the success of management of information security. Compliance of information security management with business activities of the company will also support employees' interest in increasing IT skills. Higher IT skills allow workers to achieve better results in their workplace. Compliance with security policies, standards reduce systemic risks.

The issue of information security management becomes vitally important, especially in the segment of small and medium sized enterprises. The basic reason why SMEs become a popular target for cyber-attacks is the fact that attackers are usually looking for simple goals. Small companies with limited budgets often do not consider cyber security to be important, are easier to disrupt than large ones that invest large amounts in the security of information systems (Millaire et al. 2017).

While 77% of cybercrime focuses on SMEs, 58% of SME managers do not consider cyber-attacks to be a significant risk and 65% of SMEs do not have a security policy, only 10% of computer crimes reported to the police by small and medium-sized enterprises result in the conviction of offenders (FireEye, 2016).

## Conclusions

The issue of information security management becomes vitally important, especially in the segment of small and medium sized enterprises. The aim of this paper was to identify the factors of success of information security management in segment of SMEs in Slovakia.

Based on the previous literature review we have narrowed the scope of our research and focused on 4 main factors of success of information security management, defined by most of the authors as the most important, which were *Compliance of information security management with the company's business activities*, *Support of top management*, *Security controls* and *Organizational awareness*. To identify the importance and interconnections of the specified factors we have addressed senior IT security experts from small and medium sized enterprises in Slovakia. The experts evaluated the significance of four factors from view point of success of information security management and the results of the expert evaluation were processed using the DEMATEL technique.

The results of the research show that the *Security Controls*, including technical and procedural information security controls, risk management and application of standards reflect the success of information security management is the most important factor of success of information security management. The second most important factor is the *supportive top management*. Our results also imply that the factor of organizational awareness is the most obvious and important factor for the success of information security management *in the short-term period*.

Our results imply that SMEs should promote organizational awareness in information security management in line with implementation of the security controls at the first line of the defense in order to protect the information, as the most valuable asset of the company.

Our research has some limitations, mostly related to the number of the experts involved, that was explained by the general unwillingness of the SMEs representatives to share the data about the information security management in their companies. The impact of this limitation was reduced by the usage of the DEMATEL technique, so the results are statistically representative.

## References

- ADÁSKOVÁ, P. (2009). Ekonomická krize zvyšuje zájem firem o řízení rizik. Risk-Management.cz, ISSN 1802-0496.
- ALNATHEER, M. A. 2015. Information security culture critical success factors. In: *12th International Conference on Information Technology-New Generations – Proceedings*, 2015. s.731-735
- Badulescu, D. (2012). SMEs financing: The Extend of Need and the Responses of Different Credit Structures. Theoretical and Applied Economics, 17(7), pp. 25-36
- Belás J., Macháček J., Bartoš P., Hlawiczka R., Hudáková M. (2014). Business Risks and the Level of Entrepreneurial Optimism among SME in the Czech and Slovak Republic. Journal of Competitiveness, 6(2), pp. 30-41.
- BHAIRD, C.M. (2010). Resourcing Small And Medium Sized Enterprises. Springer Verlag: Berlin, 2010.
- CULNAN, M. J., FOXMAN, E. R., RAY, A. W. 2008. Why It Executives Should Help Employees Secure Their Home Computers, In: *MIS Quarterly*, 2008. ISSN 0276-7783, roč. 7, č. 1, s. 49-56
- DAVIDAVIČIENĖ, V., RAUDELĪŪNIENĖ, J., TVARONAVIČIENĖ, M., KAUSINIS, J. 2019. The importance of security aspects in consumer preferences in electronic environment. Journal of Security and Sustainability Issues, 8(3), 399-411. [http://doi.org/10.9770/jssi.2019.8.3\(9\)](http://doi.org/10.9770/jssi.2019.8.3(9))
- DAVIDEKOVA, M., GREGUS ML., M., FARKAS, P. 2016. MATLAB implementation of the recent CCC construction approach. *International conference on telecommunications and signal processing*, TSP 2016, pp. 429-432. <https://doi.org/10.1109/tsp.2016.7760913>
- DEKÝŠ, P. 2010. Správa informačnej bezpečnosti v malej a stredne veľkej spoločnosti *e-Focus*, 2010. ISSN 1336-1805, roč. 10, č. 3, s. 12-13
- Fire Eye, Inc.. 2016. 5 reasons cyber attackers target SMEs, FireEye, 2016. [cit. 2018-10-11] Available at: [https://www.fireeye.com/content/dam/fireeye-www/global/en/offers/pdfs/SMEInfographic\\_web.pdf](https://www.fireeye.com/content/dam/fireeye-www/global/en/offers/pdfs/SMEInfographic_web.pdf)
- GRÓDEK-SZOSTAK, Z. NESTERAK, J., 2017. Trade missions as the instrument for supporting international technological cooperation of enterprises - Case study of Poland, Slovakia and Czech Republic. *Acta Oeconomica Universitatis Selye* 6 (2), 57 – 68. ISSN 1338-6581
- HAU B., PENROSE M., HALL T., BEVILACQUA M. 2016. *M-Trends*, 2016. EMEA Edition, Jún, 2016
- HENDERSON, J., WEILER, S. (2010). Entrepreneurs and Job Growth: Probing The Boundaries Of Time And Space, *Economic Development Quarterly*, 24(1), 23 – 32.
- HUANG, S., M., LEE, C. L., KAO, A.C. 2006. "Balancing Performance Measures for Information Security Management: A Balanced Scorecard Framework," In: *Industrial Management and Data Systems*, 2006. ISSN 0263-5577, roč. 106, č. 2, s. 242-255
- HUDEC, L. 2014. *Manažment informačnej bezpečnosti - csirt.sk* [cit. 2018-10-11] Available at: [https://www.csirt.gov.sk/doc/MFSRVzdelavanie/02Vzdelavanie2014/Prezentacie\\_vyssi\\_manazment\\_organizacie/PrezGR\\_Manazment\\_IB.pdf](https://www.csirt.gov.sk/doc/MFSRVzdelavanie/02Vzdelavanie2014/Prezentacie_vyssi_manazment_organizacie/PrezGR_Manazment_IB.pdf)

- CHANG, S. E., CHEN, S.Y., AND CHEN, C.Y. 2011. Exploring the Relationships between It Capabilities and Information Security Management In: *International Journal of Technology Management*, 2011. ISSN 0267-5730, roč. 54, č. 2/3, s.147- 166
- CHMIELARZ W., ZBOROWSKI M. 2017. Analysis of the Use of Electronic Banking and e-Payments from the Point of View of a Client, 2017, In: *Proceedings of the Federated Conference on Computer Science and Information Systems*, 2017. s. 965-969, [cit. 2018-05-10].
- KARPAK, B., & TOPCU, I. (2010). Small medium manufacturing enterprises in Turkey: an analytic network process framework for prioritizing factors affecting success. *International Journal of Production Economics*, 125, pp. 60–70.
- KAYWORTH, T., WHITTEN, D. 2010. Effective Information Security Requires a Balance of Social and Technology Factors, In: *MIS Quarterly Executive*, 2010. ISSN 1540-1960, roč.9, č. 3, s.163-175
- KAZEMI, M., KHAJOUEI, H., NASRABADI, H. 2012. Evaluation of information security management system success factors: Case study of Municipal organization. In: *African Journal of Business Management*, 2012, roč. 6, č. 14, s. 4982-4989. ISSN 1993-8233
- KHOURI, S. 2009. Analýza bezpečnosti informačných systémov organizácií. In *Zborník z UNINFOS 2009 (Univerzitné informačné systémy)*, 2009. Slovenská poľnohospodárska univerzita v Nitre. 2009, s. 140-144, ISBN 978-80-552-0309-6
- KORENKOVA, V., ZAVADSKY, J. LIS, M. 2019. Linking a performance management system and competencies: qualitative research. *Engineering management in production and services*, Vol. 11, No. 1, pp. 51-67. DOI: 10.2478/emj-2019-0004
- KOTULIC, A. G., CLARK, J. G. 2004. Why there aren't more information security research studies. *Information & Management*, roč. 41, č.5, s. 597-607.
- LENGYEL, P., OLÁH, J., PANCSIRA, J., FÜZESI, I., POPP, J. 2017. Advantages of using LMS in training for agricultural advisors. *Acta Oeconomica Universitatis Selye* 6(2), 109 – 118. ISSN 1338-6581
- LO, C. C., CHEN, W. J. 2012. A hybrid information security risk assessment procedure considering interdependences between controls. In: *Expert Systems with Applications*, 2012. ISSN 0957-4174, roč. 39, č., s. 247-257
- LOPES, I., OLIVEIRA, P. 2015. Implementation of information systems security policies: a survey in small and medium sized enterprises. In: *New Contributions in Information Systems and Technologies, Volume 1*, 2015. s. 459 - 468, ISBN 978-3-319-16486-1
- MA, Q., SCHMIDT, M. B., PEARSON, J. M. 2009. An Integrated Framework for Information Security Management, In: *Review of Business*, 2009. ISSN 2378-9670, roč. 30, č. 1, s. 58-69
- MACIEJEWSKI, M., WACH, K. 2019. International Startups from Poland: Born Global or Born Regional? *Journal of Management and Business Administration. Central Europe*, 27(1), 60-83. <https://doi.org/10.7206/jmba.ce.2450-7814.247>
- MANDORF, S., GREGUS, M. 2014. The e-business perspective as a solution for inertia against complexity management in SME. *Proceedings - 2014 International conference on intelligent networking and collaborative systems, IEEE INCOS 2014*, pp. 237-241
- MILLAIRE P., SATHE A., THIELEN P. 2017. What All Cyber Criminals Know: Small & Midsize Businesses With Little or No Cybersecurity Are Ideal Targets, 2017. [cit. 2018-10-11] Available at: <https://www2.chubb.com/us/en/assets/doc/17010201-cyber-for-small-midsize-businesses-10.17.pdf>
- OLAH, J., KOVACS, S., VIRGLEROVA, Z., LAKNER, Z., KOVACOVA, M., POPP, J. 2019. Analysis and comparison of economic and financial risk sources in SMEs of the Visegrad Group and Serbia. *Sustainability*, Vol. 11, No. 7, 1853. <https://doi.org/10.3390/su11071853>
- PERACEK, T., MITTELMAN, A., MUCHA, B. 2018. The Particular Aspects of Procurement Contracts of Trading in Securities in the Conditions of the Slovak Republic. *Finance and sustainability. Springer Proceedings in Business and Economics*, pp. 175-185. [https://doi.org/10.1007/978-3-319-92228-7\\_15](https://doi.org/10.1007/978-3-319-92228-7_15)
- POLKOWSKI, Z., DYSARZ, J. 2017. IT Security management in small and medium enterprises. In: *Scientific Bulletin – Economic Sciences*, 2017. ISSN 1583-1809, roč. 16, Special Issue EtaEc, s. 134-148
- RADU, L. D. 2018. Green ICT: some challenges and potential solutions. *Acta Oeconomica Universitatis Selye* 7 (2), 141 – 150. ISSN 1338-6581

RAJNOHA, R., KORAUŠ, A., & DOBROVIČ, J. (2017). Information systems for sustainable performance of organizations. *Journal of Security and Sustainability Issues*, 7(1), 167-179. [https://doi.org/10.9770/jssi.2017.6.1\(14\)](https://doi.org/10.9770/jssi.2017.6.1(14))

SKLENÁR, D., ČIMOVIČ, K. 2018. *IKT v MSP*. In: Acta Paneuropeana - Letters in economics and international business. 2018. roč. 2, ISBN 9788089453399

Slovak Business Agency. (2015). Správa o stave MSP v SR 2014. Available at: [http://www.sbagency.sk/sites/default/files/sprava\\_o\\_stave\\_msp2014.pdf](http://www.sbagency.sk/sites/default/files/sprava_o_stave_msp2014.pdf)

SOOMRO, Z.A., SHAH, M.H., AHMED, J. 2016. Information security management needs more holistic approach: a literature review, In: *International Journal of Information Management*, ISSN 0268-4012, roč. 36, č. 2, s. 215-225

SPEARS, J. L., AND BARKI, H. 2010. User Participation in Information Systems Security Risk Management. In: *MIS quarterly*, 2010. ISSN 2162-9730, roč. 30, č. 3, s. 503-522

TAN, W.K., KUO, C. Y. 2014. Prioritization of facilitation strategies of park and recreation agencies through DEMATEL analysis. In: *Asia Pacific Journal of Tourism Research*. 2014. ISSN XXXX, roč. 19, č. 8, s. 859–875

TIANSUI, W., GANG, Z. 2014. A new security and privacy risk assessment model for information system considering influence relation of risk elements. In: *2014 Ninth International Conference on Broadband and Wireless Computing, Communication and Applications IEEE*, 2014, s. 233-238. ISBN 978-1-4673-8315-8

TU, Z., YUAN, Y. 2014. Critical success factors analysis on effective information security management: A literature review. In: *Twentieth Americas Conference on Information Systems*, Savannah, 2014. s. 1-12. ISBN 978-1-6326-6753-3

TU, C. Z., YUAN, Y., ARCHER, N., CONNELLY, C. E. 2018. Strategic value alignment for information security management: a critical success factor analysis. In: *Information & Computer Security*, 2018. ISSN 2056-4961, roč. 26, č.2, s.150-170

TVARONAVIČIENĖ M. 2018. Towards internationally tuned approach towards critical infrastructure protection, *Journal of Security and Sustainability Issues*, 8(2), 143-150. [https://doi.org/10.9770/jssi.2018.8.2\(2\)](https://doi.org/10.9770/jssi.2018.8.2(2))

VERBANO, C. AND VENTURINI, K. (2013). Managing risks in SMEs: a literature review and research agenda. *Journal of Technology Management & Innovation*, 8(3), pp. 186–197.

VILCEKOVA, L., MUCHA, B., PERACEK, T., STRAZOVSKA, L. 2018. Selected issues of family business in selected countries with emphasis on the Slovak republic. *Innovation management and education excellence through Vision 2020, Vols IV -VI*, pp. 2500-2509

WALY, N., TASSABEHJI, R., KAMALA, M. 2012. Improving organisational information security management: The impact of training and awareness. In: *2012 IEEE 14th International Conference on High Performance Computing and Communication & 2012 IEEE 9th International Conference on Embedded Software and Systems*, Liverpool, UK. 2012. s. 1270-1275, ISBN 978-0-7695-4749-7

WERLINGER, R., HAWKEY, K. , BEZNOSOV, K. 2009. “An integrated view of human, organizational, and technological challenges of it security management”, In: *Information Management & Computer Security*, 2009. ISSN #0968-5227, roč. 17, č. 1, s. 4-19

WHITMAN, M. E., MATTORD, H. J. 2012. Introduction to information security. In: *Principles of Information Security*, 2012. s. 1-35. ISBN 978-1-111-13821-9

YILDIRIM, E. Y., AKALP, G., AYTAC, S., BAYRAM, N. 2011. Factors Influencing Information Security Management in Small-and Medium-Sized Enterprises: A Case Study from Turkey. In: *International Journal of Information Management*, 2011. ISSN 0268-4012, roč. 31, č. 4, s. 360-365

ZAMMANI, M., RAZALI, R. 2016. An empirical study of information security management success factors. In: *International Journal on Advanced Science, Engineering and Information Technology*, 2016. ISSN 2088-5334, roč. 6, č. 6, s. 904-913

ZAVADSKA, Z., ZAVADSKY, J. 2018. Quality managers and their future technological expectations related to Industry 4.0. *Total Quality Management and Business Excellence*, pp. 1-25. <https://doi.org/10.1080/14783363.2018.1444474>

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## ENTREPRENEURSHIP AT THE LABOUR MARKET: A CASE OF PRECARIAT AND INFORMAL EMPLOYMENT\*

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**Abstract.** The concept of precariat is becoming the increasingly important subject of interdisciplinary research that involves both qualitative and quantitative approaches. The formation of the precariat is associated with the neoliberal reforms carried out in the last decades, as well as significant institutional and technological changes. The process of precarisation is accompanied by an increase in insecurity, instability, and flexibility, which is most characteristic of informal and precarious work. Our paper analyzes the relationship between informal employment as a proxy precariat and unemployment rates, industrial production index and real wages using the structural VAR approach for monthly data in the period 2010-2018. The relationship between the variables is checked by imposing restrictions on the recursive scheme (Cholesky identification) as well as the recursive identification scheme (Cholesky decomposition) in the SVAR model. Our analysis of the impulse response caused by the positive shock of informal employment confirmed that in the short term, the increase in the share of people employed in the informal sector causes, above all, a decline in real wages. There are weak responses from the industrial production index, which leads to the conclusion about the leveling effect of institutions and institutions. In addition, the paper employs the process of modeling the development of informal employment using the ARIMA model. Our results showing the trends in the development of informal employment demonstrate the existence of cyclical resilience which negatively affects economic development and requires structural reforms.

**Keywords:** precariat; entrepreneurship; informal employment; labour market; non-standard employment

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**Additional disciplines:** structural VAR model; ARIMA; institutional economics; structural change, technological change

### 1. Introduction

The Great Recession which affected most countries in the world to some extent had a significant impact on the Russian economy, which, along with continuing economic sanctions, largely contributes to its depressive state. However, despite some institutional features, the processes taking place on the Russian labor market are in many

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ways similar to the European trends in terms of increasing instability, informality, and the flexibility of social and labor relations (Abbot et al., 2006; Stojanov et al. 2011; Jandová, 2012; Janda et al., 2013; Jiroudková et al., 2015; Abbrhám et al., 2015a, Abbrhám et al., 2015b; Čábelková et al. 2015; Strielkowski et al. 2016; Bilan, Strielkowski, 2016; or Niño-Amézquita et al., 2017; Lialina, 2019; Prakash, Garg, 2019). These processes contribute to the spread of unsustainable principles that often violate the labor rights of an employee in the field of labor remuneration and the organization of working time. The current state of the Russian labor market is characterized by various forms of asymmetry in the structure of employment, wages and labor productivity, uneven distribution of income, social vulnerability of the poor, high unemployment which gives rise to asymmetric processes of adaptation to changing market conditions.

Many people have ideas about the labour market that are shaped up by various kinds of discourses. Moreover, discourses that are formed in academic circles are very closely intertwined with discourses associated with the development of educational and economic policies (Strielkowski and Sanderson, 2013; Strielkowski and Weyskrabova, 2014; Höschle et al., 2015). From the point of view of academic discourse, the formation and satisfaction of the demand for highly educated labour depends on market, institutional, technological and other factors, depending on the scientific field in which a particular problem is analysed (Abe et al., 2015).

Over the past hundred years we are witnessing the acceleration of technological and institutional changes that have been happening in the modern world. Moreover, in terms of information technology, the speed of such changes becomes avalanche-like. Understanding the process of precarization of employment is important primarily in terms of the formation of scientific concepts and ideas (Volchik and Maslyukova, 2018) which might serve as the basis for the implementation of economic policies aimed at smoothing out acute social contradictions and forming the basis for balanced and sustainable development of people employed in new and traditional industries economy (Kalyugina et al., 2015; Kalyugina et al., 2018).

In today's world, the formation of precariat occurs under conditions when erosion of the institution of permanent employment occurs. The weakening of job security is widespread in the modern world and is associated with both technological and institutional changes, which can lead to the simultaneous coexistence of full and temporary employment within the same professional groups and sectors of the economy (Čajka et al., 2014; Lazar and Sanchez, 2019).

Technological and institutional changes inevitably lead to the formation of new conditions of employment. Perhaps we are currently witnessing a new "great transformation" (Polanyi, 1957), which will radically change the nature of market interactions, particularly in the labor market. Therefore, the widespread non-standard employment, including various forms of part-time and temporary employment (Choonara, 2019, p. 6), can be viewed in the context of the evolution of the entire capitalist employment system.

Institutional changes in modern developed and developing capitalist economies are closely related to cumulative processes of technological change. The development of information and digital technologies is associated with the problem of evolutionary complexity and adaptive behavior of an economy (Arthur, 1994; Arthur, 1999; and Arthur, 2014). The development of the precariat can also be viewed in the context of the formation of behavioral patterns as an adaptation to institutional and technological changes, as well as to the ongoing state economic policy. Nevertheless, studies of the precariat are beyond the scope of economic issues per se, and therefore ethical and social values matter (Colander, 2014). This becomes especially relevant when one analyses institutions and regulatory mechanisms in contexts of sustainability and welfare in a complex adaptive system. Therefore, it seems that the evolution of institutions and regulatory measures can be viewed through the prism of smoothing dangerous tensions in social, political, and economic contexts.

## 2. Labour market, employment, and precariat

In the modern world of increasing returns and complexity, competitive advantages are gained by those activities that can best adapt the progress of technologies to their production processes and products. Therefore, the development of information technology, which is associated with the formation of new forms of often unstable employment, can be considered as one of the objective reasons for the formation of the precariat (Mramornova et al., 2019, p. 518). The forms of employment in the free earnings economy (gig economy) are becoming more widespread. In such conditions, there is a redistribution of risk from the state and employers to ordinary citizens engaged in the economy of free earnings (Thelen, 2019, p. 2). These processes can be considered in connection with changes in the institutional regulation of employment. Starting from the middle of the 19th century, the emergence of labor contracts and relevant legislation allowed us to withdraw from the regulation of labor relations on the basis of civil law contracts (Ferguson, 2013). The return to the elements of civil-law regulation of employment can also be viewed as one of the factors of modern precarious work of employment.

The formation of the precariat takes place under the conditions of a tough struggle among intellectual currents, which, going beyond the limits of academic discussions, become instruments for economic policy. Labor market flexibility is seen as a factor in the development of market relations, which, according to neoliberal theories, should affect the efficiency of the use of labor resources. However, labor market flexibility is associated not only with the new needs of workers on a free schedule, but also with the market power of employers (Shammas, 2018, p. 415). Neoliberal economic policies, which are developed under the banner of increased efficiency, in practice are often associated with increased bureaucratic oppression (Graeber, 2015), formalism and control (Strielkowski, 2017; Volchik, 2018), which can cause drift towards informal and partial employment. The processes of globalization and migration associated with it may also be one of the actors of precariatization (Bernards, 2017), which in turn is associated with government policies aimed at protecting the internal labor market.

Hyper-individualization of workers who, for example, are engaged in freelancing in the academic field (Izharuddin, 2018) can serve as another side of precariatism. The decline of the trade union movement leads to the atomization of workers and adversely affects the ability to jointly defend their rights. Although in some cases strong trade unions may pursue a paternalistic policy towards the unemployed or informally employed, which in turn may lead to ambiguous consequences (Paret, 2018).

Hyper-individualization can be viewed as a continuation of the marketization of professional activity in the digital economy, as well as the spread of outsourcing as a source of precarious work (Siegmann and Schiphorst, 2016, pp 116-117). Depending on the particular institutional environment in various sectors of the economy, precarious employment increases the risk of crowding out workers with a legal and protected status into the sphere of informal employment. Sure? There are some differences primarily in the genesis of informal and non-standard employment, but both of these forms of employment are associated with insecurity and labor insecurity, which allows them to be regarded as forms of precariat (Siegmann and Schiphorst, 2016, p. 115).

The precariate includes groups of the population that are heterogeneous in their social composition, which makes it impossible to establish exact boundaries. In addition, as noted by Gasiukova et al. (2016): “*the conditions for the formation of the Russian precariat were radically different from the conditions for its formation in Western societies*”.

One of the reasons for precarization of employment is the imbalance between the formation of labor and the demand for it existing in the Russian labor market. These differences lead to inconsistencies between the skill level of workers and the jobs they occupy, and the deterioration of the quantitative and qualitative structure of the labor market. Another reason for precarization of employment is “flexibility of numbers”, due to the fact that for a long time it was called “atypical” and “non-standard” form of labor: temporary, part-time employment,

outsourcing, offshoring, “contract with zero time”, forced “unpaid leave”, the use of interns (Standing, 2011). In the structure of the precariat, the main groups usually include informal employment, temporary and part-time employment, seasonal and fragmentary (episodic) employment, employment and freelancing, the unemployed, migrant workers, students and interns, and NEET youth (Not in Employment, Education or Training) - young people who do not study, do not work and do not participate in vocational training (Toshchenko, 2018).

From the point of view of changes in the economic environment and structural changes, it is important to study the structural factors of precariousization of employment and to characterize the shocks that lead to changes in the level of precarization of employment. The study of the influence of various macroeconomic shocks on the development of the precariate in Russian society is particularly relevant and important for understanding the causes of unstable employment in the context of adaptation to technological, institutional and economic changes in the labor market.

The aim of our study is an empirical analysis and econometric modeling of the nature of the dynamic relationship between indicators characterizing the level of development of informal employment and the state of the labor market based on the SVAR model. The analysis will allow us to characterize the relationship between the level of economic development, unemployment and informal employment (proxy precariat) in the dynamics.

In Russian conditions, informal employment often complements the official employment, since the level of “white” official wages remains extremely low, except for the capital region. Informal employment is widespread both in areas that require higher education and high qualifications (teachers, doctors), and in the services sector, construction, agriculture, where high qualifications are not required. The excessive state regulation of various industries and the lack of structural reforms are associated with the formation of an institutional environment in which competitive market interactions are forced into the shadow and informal economy, which, for example, is typical of Latin American countries (De Soto, 2001).

Most of the studies dealing with the precariat phenomenon use qualitative methods (Choonara, 2019; Volchik et al., 2018) which is due to on the one hand the vagueness of the theoretical framework, and on the other hand the lack of relevant statistical data that can be used in quantitative analysis. However, the precariat issue may be successfully explored in the future as its theoretical framework improves, as well as through the use of proxy variables. In our paper, we explore the precariat in the context of the impact of informal employment on instability and vulnerability in the labor market, which allows us to consider informal employment as a proxy of the precariat.

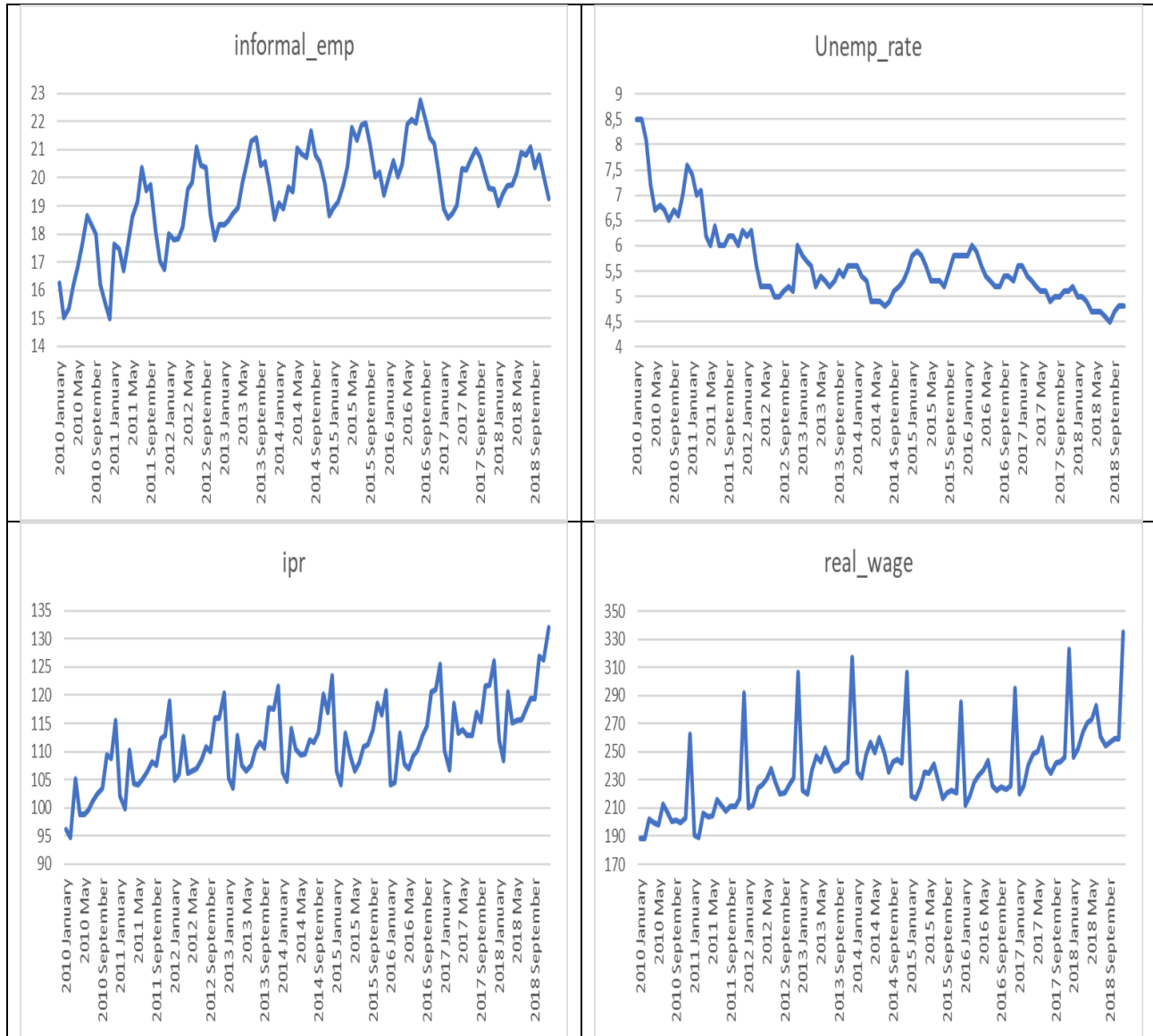
### 3. Data and the empirical model

For the empirical analysis and modeling of the dynamic relationship between these indicators, we employed the time series empirical model based on the data of monthly dynamics for the period from January 2010 to December 2018. The information statistical array (108 observations) is formed on the basis of data regularly published by the Russian Federal State Statistics Service. The model takes into account the following variables:

*informal\_emp* - the share of people employed in the informal sector (in% of the total number of employed people) is a proxy variable characterizing the level of development of the precariat. When choosing this variable as a proxy of precariat, we relied on the concept of Standing (2011), who noted that “the shadow economy is exactly the place where most of the precariat is acquired, subjected to exploitation and oppression.” “The globalizing open market economy, which is characterized by informal contracts, partial and temporary employment, focus on projects and a myriad of personal services, undoubtedly contributes to shadow labor” (Standing, 2011).

In accordance with the methodology of the Russian Federal State Statistics Service (2019), those employed in the informal sector are persons who during the survey period were employed in at least one of the production units of

the informal sector, regardless of their employment status and whether this work was for them the main or additional. The criterion for the lack of state registration as a legal entity was adopted as the criterion for determining units of the informal sector.



**Fig.1.** The dynamics of model variables

Source: Own results

- *unemp\_rate* - unemployment rate, %;

- *ipr* - industrial production index of Higher School of Economics. This variable is used as a proxy for business activity and is calculated on the basis of time series of monthly dynamics in real terms of 272 most important types of products, the production volumes of which constitute a rather significant specific weight in the total industrial output.



- *real\_wage* - real wages, January 1993 = 100%.

The index *unemp\_rate* variables that marks the unemployment rate characterizes the efficiency and scale of development of the formal sector of the economy, presenting demand for labor. Thus, Gimpelson and Zudina (2011) note that “reducing unemployment in the region means activating demand and, accordingly, reducing the share of the informal sector”. In addition, Tedds and Giles (2002) distinguish two opposite directions of the relationship between unemployment and the informal sector. On the one hand, increasing unemployment may lead to a decline in the informal sector, since it is positively associated with GDP growth rates and ultimately negatively correlates with unemployment (Okun’s law). On the other hand, rising unemployment leads to an increase in the number of people employed in the informal sector. During the period under review, there is a tendency for this indicator to decrease.

*Indicator ipr* - industrial production index - is the most well-known and widely used indicator. In this case, other things being equal, it can be assumed that the higher the level of activity is, the more reason to expect the scale of the development of the formal sector, and vice versa.

The level of real wages (the “*real\_wage*” variable) allows us to present the degree of attractiveness of the formal sector for employees. In this case, other things being equal, it can be assumed that if the level of real wages is higher, the spread of employment in the informal sector of the economy may be lower. The dynamics of indicators is presented in Figure 1 above.

#### 4. Result and discussions

Initially, a preliminary statistical test of the time series for the presence of the seasonal component and stationarity was carried out. Based on the results obtained in the graphical analysis of the initial data (Fig. 1), it was concluded that there is a seasonal component in all time series. In addition, none of the considered time series looks stationary. Therefore, before evaluating the VAR model in abbreviated form, we will test the non-stationary nature of the studied series using the Dicky-Fuller test (Augmented Dickey-Fuller test) and KPSS test (the so-called Kwiatkowski-Phillips-Schmidt-Shin test). In the first test, the null hypothesis about the presence of a unit root was tested; in the second test, the null hypothesis was the stationarity of the series. Given the shape of the time series shown in Figure 1, stationarity was tested against a constant and trend. Testing the initial time series indicates the presence of a unit root in the data on the variable *informal\_emp* (the share of employment in the informal sector) and *unemp\_rate* (unemployment rate), while tests of the variables *ipr* (industrial production index) and *real\_wage* (real wage) gave mixed results, but in terms of the total population, it can be concluded that the series under consideration are not stationary (Table 1).

**Table 1.** Single root analysis

Variable	ADF statistics	KPSS test
<i>informal_emp</i>	-1.2988	0.2263
<i>unemp_rate</i>	-3.9914	0.1809
<i>ipr</i>	-1.337	0.1314
<i>real_wage</i>	-2.7755	0.1232
<i>Critical values of statistics</i>		
1%	-3.99	0.216
5%	-3.43	0.146
10%	-3.13	0.119

Source: Own results



After reducing the series to a stationary view by taking seasonal and non-seasonal differences, the VAR (1) model was evaluated in an abbreviated form, the number of lags was determined automatically on the basis of information criteria taking into account the constant (Table 2).

**Table 2.** The choice of the number of lags in the model

AIC(n)	HQ(n)	SC(n)	FPE(n)
1	1	1	1

Source: Own results

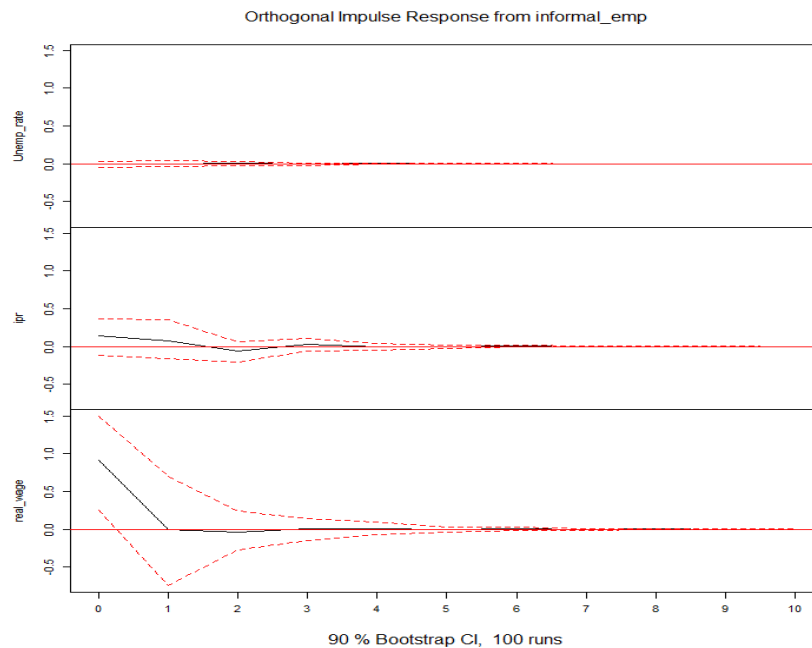
The results of evaluations of the abbreviated form of the VAR (1) model are given in Appendix 1. From a statistical point of view, the constructed model is adequate. Thus, based on the results of the tests performed, it can be concluded that the model remains missing the problem of autocorrelation, as evidenced by the p-values of the portmanto test for 10 counted lags (Table 3).

**Table 3.** Portmanto test for residual autocorrelation

	Chi-squared	p-value
Portmanteau Test asymptotic	154	0.28
Portmanteau Test adjusted	164	0.12
Breusch-Godfrey LM test	79.4	0.5

Source: Own results

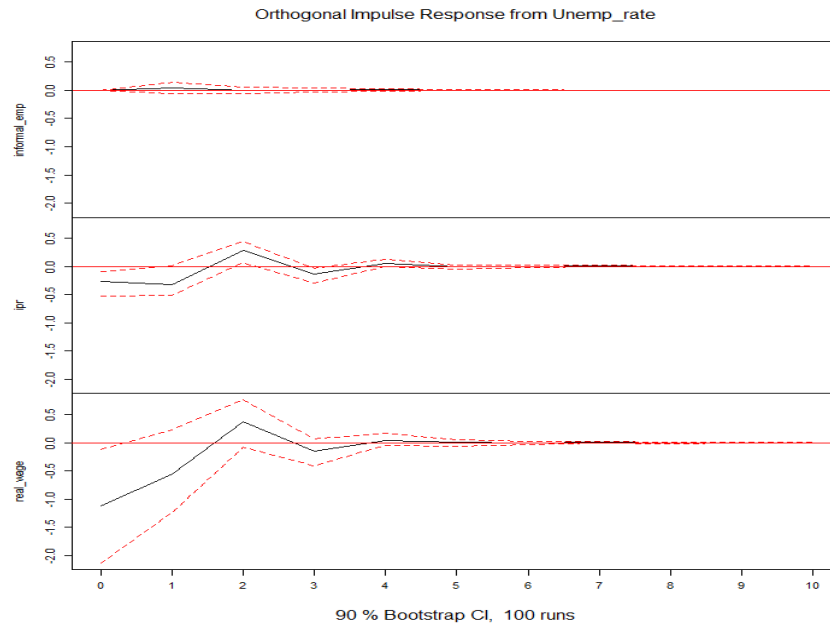
When looking at Figure 2 that follows, one can see that the positive shock of the share of those employed in the informal sector causes, above all, a decline in real wages, while the duration of such a decline is small and is two months.



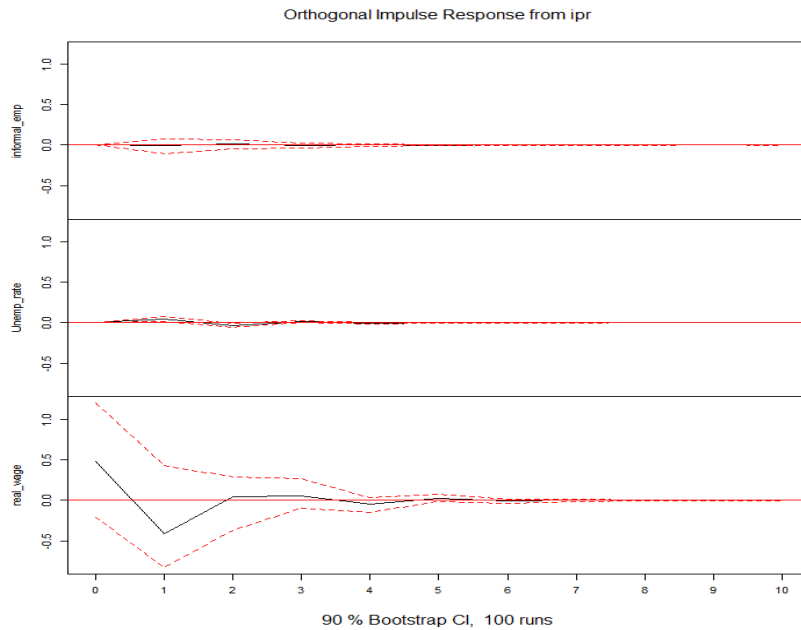
**Fig. 2.** Functions of impulse responses to the positive shock of the variable *informal\_emp* - the share of people employed in the informal sector

Source: Own results

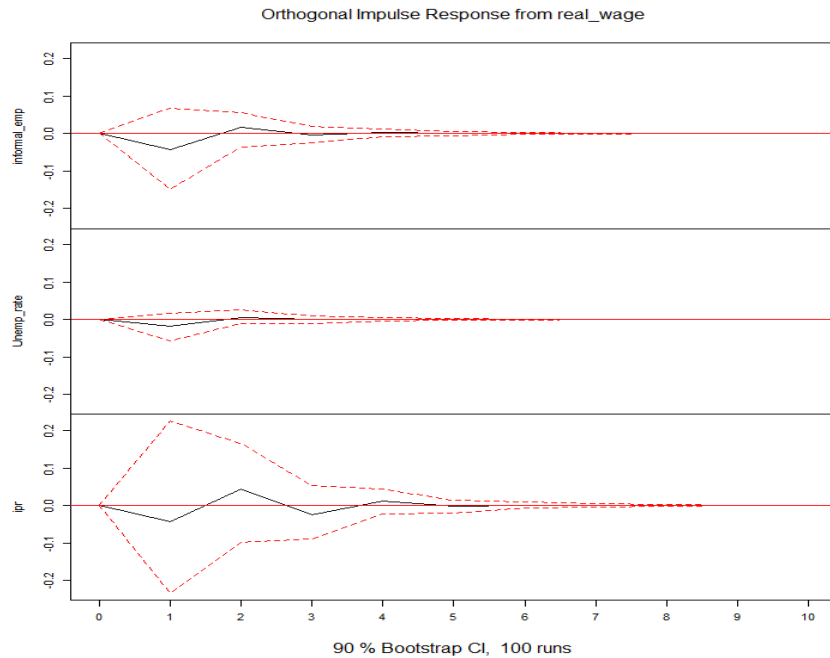
Also, there is a weak reaction of the industrial production index, which is reflected in its slight decrease within two months.



**Fig. 3.** Impulse response functions for positive shock of the variable *unemp\_rate* - unemployment rate  
Source: Own results



**Fig. 4.** Functions of impulse responses to positive shock by variable *ipr* - industrial production index  
Source: Own results



**Fig. 5.** Impulse response functions for positive shock variable *real\_wage* - real wage  
Source: Own results

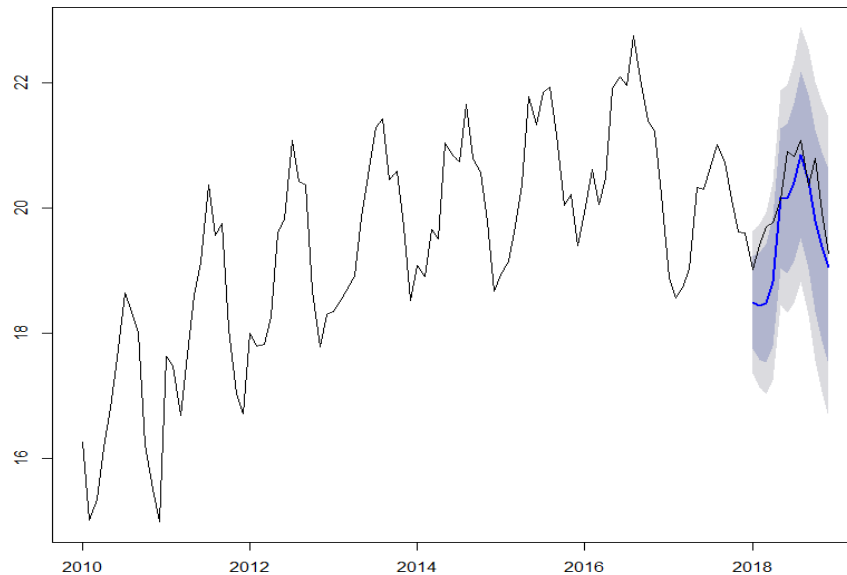
The response of real wages to the shock of unemployment turns out to be positive, and the growth of the industrial production index in response to the positive shock of unemployment has been observed since the second month (Fig. 3). Moreover, the growth of the industrial production index in the short term contributes to a decrease in real wages during the first month, but during the second month real wages return to their previous level (see Figure 4 above). The response of the share of those employed in the informal sector to the shock of real wages turns out to be negative during the first month, while the positive response of the industrial production index is observed starting from the second month (Figure 5 above). The identified short-term effects under the influence of the prevailing institutional structure (environment) of the precariat are leveled over a short time period (length of two months), bringing the indicators to their original values.

As it comes out from Figures 2-5, the confidence interval of the response functions for all variables captures zero, which indicates a statistically insignificant short-term effect of macroeconomic indicators in the period under review, therefore, using ARIMA is proposed to predict informal employment (values of the variable *informal\_emp* - employment in the informal sector). Since the Dickey-Fuller test indicates that the series under study is unsteady, to determine the model parameters, we used automatic generation of a set of optimal model parameters taking into account the seasonality identified earlier and taking into account the order of integration equal to  $p = 1$  (see Table 4 that follows).

**Table 4.** Results of the evaluation of the parameters of ARIMA model (0,1,1) (0,1,1)

	mal	sma1
Coefficients:	-0.441	-0.326
s.e.	0.116	0.126
sigma <sup>2</sup> estimated as 0.337: log likelihood=-72.45		
AIC=150.9 AICc=151.2 BIC=158.15		

Source: Own results



**Fig. 6.** Prediction of the level of informal employment and confidence intervals.

*Source:* Own results

The analysis of the obtained model indicates the absence of autocorrelation in the residuals (Box-Ljung test:  $\chi^2 = 23.8$ ,  $df = 22$ ,  $p\text{-value} = 0.36$ ). Therefore, this model can be used for prediction. Testing the model on the so-called quasi-data (that is, building a forecast for the last known levels of time series using the model built without them) showed that the actual values are described quite well by this model: the blue line representing the forecast approaches the original data quite well, the forecast estimates confidence limits are provided: 80% confidence limits are shaded in dark blue, and 95% confidence limits are in lighter blue (see Figure 6 above).

The results of our empirical model allow us to conclude that the trends in the development of informal employment demonstrate cyclical resilience, which requires economic policies that promote economic restructuring and the formation of appropriate institutions to protect the rights of workers in traditional and developing industries and spheres.

## Conclusions

Overall, our results demonstrate that in modern Russia precarious employment is associated with the formation of sustainable institutional structures. Institutionalization of precariat leads to the transfer of the properties of institutions: inertia and leveling (stabilizing) effect of economic fluctuations to the situation with informal employment.

The stability of the precariat as a social stratum is indirectly confirmed by data on the stability of informal employment. Moreover, since 2012, informal employment is characterized by a persistently high level with pronounced seasonality. In the Russian context, the institutionalization of the precariat gradually occurs, which is primarily associated with the formation of stable institutions of informal employment. Institutions and institutional structure that promote precariatization adversely affect the development prospects of the Russian economy. In the medium term, the social insecurity of the precariat will affect the quality of the human capital of the able-bodied population, which is of particular relevance in the context of rapid technological changes in the information and digital economy.

All in all, it becomes apparent that strict government regulation aimed at combating informal employment does not give tangible results in the Russian context. One of the directions for state policy in these conditions may be a concentration on creating business infrastructure (including using digital technologies) and deregulation aimed at reducing barriers that have shown their inefficiency. It is also necessary not to reduce, and possibly increase, state funding for programs of various levels of vocational training due to insufficient population demand for them. Therefore, precariat studies are part of the fundamental scientific problem of instability and asymmetry in the labor market, which requires further research on the relationship between the development of the system of education and training and precarious work.

#### Appendix 1. Results of the evaluation of the reduced VAR model

```
VAR Estimation Results:
=====
Endogenous variables: informal_emp, Unemp_rate, ipr, real_wage
Deterministic variables: const
Sample size: 94
Log Likelihood: -505.383
Roots of the characteristic polynomial:
0.436 0.436 0.292 0.063
Call:
VAR(y = precariat_ts_2, p = 1, type = "const")

Estimation results for equation informal_emp:
=====
informal_emp = informal_emp.l1 + Unemp_rate.l1 + ipr.l1 + real_wage.l1 + const

              Estimate Std. Error t value Pr(>|t|)
informal_emp.l1 -0.28621    0.10128   -2.83  0.0058 **
Unemp_rate.l1    0.08336    0.26222    0.32  0.7513
ipr.l1           -0.00326    0.04439   -0.07  0.9415
real_wage.l1     -0.01056    0.01532   -0.69  0.4923
const            -0.03268    0.06422   -0.51  0.6121
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.621 on 89 degrees of freedom
Multiple R-Squared: 0.0994,    Adjusted R-squared: 0.059
F-statistic: 2.46 on 4 and 89 DF,  p-value: 0.0513

Estimation results for equation Unemp_rate:
=====
Unemp_rate = informal_emp.l1 + Unemp_rate.l1 + ipr.l1 + real_wage.l1 + const

              Estimate Std. Error t value Pr(>|t|)
informal_emp.l1 -0.01311    0.03892   -0.34  0.7370
Unemp_rate.l1   -0.28182    0.10077   -2.80  0.0063 **
ipr.l1           0.03672    0.01706    2.15  0.0341 *
real_wage.l1     -0.00416    0.00589   -0.71  0.4817
const            0.01276    0.02468    0.52  0.6063
---
```

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.239 on 89 degrees of freedom  
Multiple R-Squared: 0.142, Adjusted R-squared: 0.103  
F-statistic: 3.68 on 4 and 89 DF, p-value: 0.00808

Estimation results for equation ipr:

=====

ipr = informal\_emp.ll + Unemp\_rate.ll + ipr.ll + real\_wage.ll + const

	Estimate	Std. Error	t value	Pr(> t )
informal_emp.ll	0.2313	0.2221	1.04	0.3005
Unemp_rate.ll	-1.8567	0.5749	-3.23	0.0017 **
ipr.ll	-0.4143	0.0973	-4.26	5.1e-05 ***
real_wage.ll	-0.0106	0.0336	-0.32	0.7533
const	0.0270	0.1408	0.19	0.8484

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.36 on 89 degrees of freedom  
Multiple R-Squared: 0.226, Adjusted R-squared: 0.191  
F-statistic: 6.51 on 4 and 89 DF, p-value: 0.000122

Estimation results for equation real\_wage:

=====

real\_wage = informal\_emp.ll + Unemp\_rate.ll + ipr.ll + real\_wage.ll + const

	Estimate	Std. Error	t value	Pr(> t )
informal_emp.ll	0.1744	0.7284	0.24	0.81
Unemp_rate.ll	-3.0690	1.8858	-1.63	0.11
ipr.ll	-0.2735	0.3193	-0.86	0.39
real_wage.ll	-0.0945	0.1102	-0.86	0.39
const	0.1704	0.4619	0.37	0.71

Residual standard error: 4.47 on 89 degrees of freedom  
Multiple R-Squared: 0.0389, Adjusted R-squared: -0.00428  
F-statistic: 0.901 on 4 and 89 DF, p-value: 0.467

Covariance matrix of residuals:

	informal_emp	Unemp_rate	ipr	real_wage
informal_emp	0.38605	-0.00152	0.0901	0.567
Unemp_rate	-0.00152	0.05702	-0.0653	-0.270
ipr	0.09012	-0.06534	1.8558	1.080
real_wage	0.56661	-0.26964	1.0803	19.968

Correlation matrix of residuals:

	informal_emp	Unemp_rate	ipr	real_wage
informal_emp	1.0000	-0.0102	0.106	0.204



Unemp_rate	-0.0102	1.0000	-0.201	-0.253
ipr	0.1065	-0.2009	1.000	0.177
real wage	0.2041	-0.2527	0.177	1.000

Source: Own results

## References

- Abbot, C.; Jeong, K.; Allen, S. 2006. The economic motivation for innovation in small construction companies, *Construction Innovation* 6(3):187-196. <https://doi.org/10.1108/14714170610710686>
- Abe, M.; Troilo, M.; Batsaikhan, O. 2015. Financing small and medium enterprises in Asia and the Pacific, *Journal of Entrepreneurship and Public Policy* 4(1):2-32. <https://doi.org/10.1108/JEPP-07-2012-0036>
- Abrahám, J.; Bilan, Y.; Krauchenia, A.; Strielkowski, W. 2015a. Planning horizon in labour supply of Belarusian small entrepreneurs, *Economic research-Ekonomska istraživanja* 28(1):773-787. <https://doi.org/10.1080/1331677X.2015.1084238>
- Abrahám, J.; Strielkowski, W.; Vošta, M.; Šlajs, J. 2015b. Factors that influence the competitiveness of Czech rural small and medium enterprises, *Agricultural Economics-Zemедельска Ekonomika* 61(10):450-460. doi: <https://doi.org/10.17221/63/2015-AGRICECON>
- Arthur, W. B. 1994. Inductive reasoning and bounded rationality, *The American Economic Review* 84(2):406-411
- Arthur, W. B. 1999. Complexity and the economy, *Science* 284(5411):107-109. <https://doi.org/10.1126/science.284.5411.107>
- Arthur, W. B. 2014. *Complexity and the Economy*. 1<sup>st</sup> edn. Oxford University Press.
- Bernards, N. 2017. The global governance of informal economies: the International Labour Organization in East Africa, *Third World Quarterly* 38(8):1831-1846. <https://doi.org/10.1080/01436597.2016.1260448>
- Bilan, Y.; Strielkowski, W. 2016. Migration in post-transition economies: immigration surplus in Visegrad group countries, *International Journal of Trade and Global Markets* 9(2):182-196. <https://doi.org/10.1504/IJTG.2016.076310>
- Choonara, J. 2019. *Insecurity, Precarious Work and Labour Markets: Challenging the Orthodoxy*. 1<sup>st</sup> edn. Springer, New York. <https://doi.org/10.1007/978-3-030-13330-6>
- Colander, D. 2014. The economics of influence, *Journal of Economic Issues* 48(2):485-492. <https://doi.org/10.2753/JEI0021-3624480223>
- Čábelková, I.; Abrahám, J.; Strielkowski, W. 2015. Factors influencing job satisfaction in post-transition economies: the case of the Czech Republic, *International Journal of Occupational Safety and Ergonomics* 21(4):448-456. <https://doi.org/10.1080/10803548.2015.1073007>
- Čajka, P.; Jaroszewicz, M.; Strielkowski, W. 2014. Migration Incentives and Flows between Belarus, Moldova, Ukraine and the European Union: a Forecasting Model, *Economics and Sociology* 7(4):11-25. <https://doi.org/10.14254/2071-789X.2014/7-4/1>
- De Soto, H. 2001. *The Mystery of Capital: why capitalism triumphs in the West and fails everywhere else*, 1<sup>st</sup> edn. Black Swan, London
- Ferguson, N. 2013. *The Great Degeneration – How Institutions Fail and Economies Die*. 1<sup>st</sup> edn. Penguin Books, London
- Gasiukova E.; Karacharovskiy V.; Yastrebov G. 2016. Unequal Precariousness: On the Origin and Forms of Social Status Instability of Individuals and Groups, *Social Sciences and Contemporary World* 3:48-63
- Gimpelson V.; Zudina A. 2011. Informal Workers in the Russian Economy: Who Are They and How Many? *Voprosy Ekonomiki* 10:53-76. <https://doi.org/10.32609/0042-8736-2011-10-53-76>
- Graeber, D. 2015. *The utopia of rules: On technology, stupidity, and the secret joys of bureaucracy*. 1<sup>st</sup> edn. Melville House Publishing
- Höschle, F.; Strielkowski, W.; Tcukanova, O.; Welkins, E. 2015. Locational preference and unemployment of Asian-born immigrant in the US metropolises, *Geographica Pannonica* 19(2): 58-63. <https://doi.org/10.5937/GeoPan1502058H>
- Izharuddin, A.; Lee, L.; Leng, K. S.; Samsurijan, M. S.; Gopal, P. S.; Malek, N. M.; Annuar, S. N. S. 2018. Precarious Intellectuals: The Freelance Academic in Malaysian Higher Education, *Kajian Malaysia* 36(2):1-20. <https://doi.org/10.21315/km2018.36.2.1>
- Janda, K.; Rausser, G.; Strielkowski, W. 2013. Determinants of Profitability of Polish Rural Micro-Enterprises at the Time of EU Accession, *Eastern European Countryside* 19:177-217. <https://doi.org/10.2478/eec-2013-0009>

- Jandová, P. 2012. Migration and economic conditions in the EU: a case study of immigrants in Germany. *International Economics Letters* 1(1):41-48. . <https://doi.org/10.24984/iel.2012.1.1.4>
- Jiroudková, A.; Rovná, L. A.; Strielkowski, W.; Šlosarčík, I. 2015. EU Accession, Transition and Further Integration for the Countries of Central and Eastern Europe, *Economics and Sociology* 8(2):11-25. <http://dx.doi.org/10.14254/2071-789X.2015/8-2/1>
- Kalyugina, S.; Pianov, A.; Tvaronavičienė, M.; Sorokin, G. 2018. Depopulation and external migration as the institutional risks to personnel safety, *Journal of institutional studies*, 10(4): 125-144. [10.17835/2076-6297.2018.10.4.125-144](https://doi.org/10.17835/2076-6297.2018.10.4.125-144)
- Kalyugina, S.; Strielkowski, W.; Ushvitsky, L.; Astachova, E. 2015. Sustainable and secure development: facet of personal financial issues, *Journal of Security & Sustainability Issues* 5(2):297–304. [https://doi.org/10.9770/jssi.2015.5.2\(14\)](https://doi.org/10.9770/jssi.2015.5.2(14))
- Lazar, S.; Sanchez, A. 2019. Understanding labour politics in an age of precarity, *Dialectical Anthropology* 43(1):3-14. <https://doi.org/10.1007/s10624-019-09544-7>
- Lialina, A. 2019. Labor market security in the light of external labor migration: new theoretical findings, *Entrepreneurship and Sustainability Issues* 6(3): 1105-1125. [http://doi.org/10.9770/jesi.2019.6.3\(11\)](http://doi.org/10.9770/jesi.2019.6.3(11))
- Mramornova, O. V.; Ivanova, N. A.; Sokolova, O. Y.; Musaeva, A. Z.; Abutalimova, S. S. 2018. Social Precarization in Post-Soviet Countries: Common Features and Differences. In: *International Conference Project "The future of the Global Financial System: Downfall of Harmony"*. 1<sup>st</sup> edn. Springer, Cham, pp. 516-527. [https://doi.org/10.1007/978-3-030-00102-5\\_54](https://doi.org/10.1007/978-3-030-00102-5_54)
- Niño-Amézquita, J.; Dubrovsky, V.; Jankurová, A. 2017. Innovations and competitiveness in regional development: a comparison of Latin America, Europe, and China, *Czech Journal of Social Sciences, Business and Economics* 6(1):28-36. <https://doi.org/10.24984/cjssbe.2017.6.1.4>
- Paret, M. 2018. Building Labor Solidarity in Precarious Times: The Danger of Union Paternalism, *Labor Studies Journal*, 0160449X18814310. <https://doi.org/10.1177/0160449X18814310>
- Polanyi, K. 1957. *The Great Transformation: The Political and Economic Origins of Our Time*, 1<sup>st</sup> edn. Boston, N.J.: Beacon Press, 546p.
- Prakash, R., Garg, P. 2019. Comparative assessment of HDI with Composite Development Index (CDI), *Insights into Regional Development* 1(1): 58-76. [https://doi.org/10.9770/ird.2019.1.1\(5\)](https://doi.org/10.9770/ird.2019.1.1(5))
- Shammas, V. L. 2018. Superfluity and insecurity: Disciplining surplus populations in the Global North, *Capital & Class* 42(3):411-418. <https://doi.org/10.1177/0309816817738319>
- Siegmann, K.A., Schiphorst, F. 2016. Understanding the globalizing precariat: From informal sector to precarious work, *Progress in Development Studies* 16(2):111-123. <https://doi.org/10.1177/1464993415623118>
- Standing, G. 2011. *The Precariat: The New Dangerous Class*. 1<sup>st</sup> edn. Bloomsbury Academic Press. <https://doi.org/10.5040/9781849664554>
- Stojanov, R.; Strielkowski, W.; Drbohlav, D. 2011. Labour migration and remittances: current trends in times of economic recession, *Geografie* 116(4):375-400
- Strielkowski, W. 2017. Predatory journals: Beall's List is missed, *Nature* 544(7651):416. <http://doi.org/10.1038/544416b>
- Strielkowski, W.; Sanderson, M. 2013. Structural channels for Ukrainian labour migration in the Czech Republic, *Trames - Journal of the Humanities and Social Sciences* 17(3):313-323. <https://doi.org/10.3176/tr.2013.3.06>
- Strielkowski, W.; Tumanyan, Y.; Kalyugina, S. 2016. Labour Market Inclusion of International Protection Applicants and Beneficiaries, *Economics and Sociology* 9(2):293-302. <http://doi.org/10.14254/2071-789X.2016/9-2/20>
- Strielkowski, W.; Weyskrabova, B. 2014. Ukrainian Labour Migration and Remittances in the Czech Republic. *Tijdschrift voor economische en sociale geografie* 105(1):30-45. <https://doi.org/10.1111/tesg.12052>
- Tedds, L. M.; Giles, D. E. 2002. Taxes and the Canadian underground economy. *Taxes and the Canadian underground economy*, Toronto: Canadian Tax Foundation [https://www.ctf.ca/ctfweb/en/publications/product\\_detail.aspx?prod=TP106](https://www.ctf.ca/ctfweb/en/publications/product_detail.aspx?prod=TP106)
- Thelen, K. 2019. The American Precariat: US Capitalism in Comparative Perspective, *Perspectives on Politics* 17(1):5-27. <https://doi.org/10.1017/S1537592718003419>
- Toshchenko Zh.T. 2018. Precariat: from Protoclass to a New Class. Monograph. 1<sup>st</sup> edn. Institute of Sociology, Russian Academy of Sciences, Russian State University for the Humanities, Moscow: Nauka.
- Volchik V.V. 2018. The Rise of Metrics, *Terra Economicus* 16(4): 6-16. <https://doi.org/10.23683/2073-6606-2018-16-4-6-16>

Volchik, V. V.; Maslyukova, E. V. 2018. Narratives, Ideas and Institutions, *Terra Economicus* 16(2): 150–168. <https://doi.org/10.23683/2073-6606-2018-16-2-150-168>

Volchik, V.; Klimenko, L.; Posukhova, O. 2018. Socio-economic sustainable development and the precariat: a case study of three Russian cities. *Entrepreneurship and Sustainability Issues* 6(1):411–428. [https://doi.org/10.9770/jesi.2018.6.1\(25\)](https://doi.org/10.9770/jesi.2018.6.1(25))

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## THE MODERN PARADIGM OF ADVERTISING IN THE LIGHT OF SUSTAINABLE BUSINESS DEVELOPMENT

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**Abstract.** The article analyzes the features of modern advertising paradigm that organically combines commercial and creative components. This paradigm is formed as a result of an evolution of both marketing and socio-cultural needs. The use of basic, synthetic and creative tools of marketing communications based on the concept of communication marketing creates a synergistic effect in the management of product promotion. Communication marketing is considered as a universal component of all links of the marketing chain. Its integrating principle is creativity. The role of advertising as an important component of communication marketing is revealed. Creative approach in advertising turns into effective marketing strategy that implements both aforementioned components of modern advertising. Revealed are the informative, perceptive, interactive aspects of advertising that reflect its communicative nature. Creative advertisements expand the semantic context of an advertising message. As a result, the importance of the study of perceptual processes, which are considered in the article from the point of view of Gestalt psychology and the laws of creating communicative patterns, increases. The role of mythology design in the creation of a new brand is also revealed. In accordance with this task the article analyzes the nature of advertising myth-making by analogy with archaic mythological thinking. Features of this archaic mythological thought enable us to clarify the socio-cultural projection of advertising myth-making as a manifestation of myth-production technologies.

**Keywords:** communication marketing, creative advertising, myth design, myth, brand, aestheticization, allusion, advertising communication, perception, Gestalt, "commodity aesthetics".

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**JEL Classification:** M37

## **1. Introduction**

Advertising is rightfully considered to be one of the most effective directions of marketing activity. In the conditions of development of market relations, characterized by relations of competition, advertising is a powerful tool for the development of the economy of capitalist entrepreneurship. The study of the processes of transformation of advertising leads to the conclusion that such type of cultural texts ceases to be just one of the tools of marketing – an attractor, directing people's attention to the subject of advertising. For a long period of time advertising not only stimulates consumption, but also determines it, generating its own dynamic system of values and short-term trends.

Modern marketing is focused on the development of a new paradigm that adequately reflects the processes of transformation of advertising in the information society. Scientific analysis of modern marketing processes shows that the reasons for the lack of effectiveness of advertising are largely due to its inadequacy to the trends of development of the modern socio-cultural situation. To simplify the mechanisms, speed up the processes and improve the quality of perception of trade offers by target audiences, advertising actively uses the experience gained by fundamental science in the fields of communication, economics, and aesthetic perception and creativity. Prospects for the development of the global advertising market are fine enough due to the tightening of competition for the effective place of the brand in the minds of the consumers. In modern practice of mass communications advertising is not only a way of transmitting commercial information. Creative approach to design, copywriting, production and placement of advertising in mass media becomes a strategic tool of communicative success of any business. The creative component of advertising becomes a vehicle for economic optimization of procedures such as coding, sending, acceptance and decoding of trade offers by target consumers. Creative idea is the key to the success of any advertising campaign aimed at solving significant branding problems. Creativity is considered to be the most complex part in the production hierarchy of advertising. The most carefully thought-out marketing strategy will not be successfully implemented if it is not supported by modern competitive non-standard solutions. Creativity in advertising can be considered as one of the tools to improve the competitiveness of business.

Creative approach to the production of advertising is focused on the active participation of consumers not only in the selection of a product and service, but also on providing them with opportunities for socio-cultural self-affirmation, self-presentation through consumer choice and consumer behavior.

## **2. Conceptual framework, research methods and scope of the study**

The novelty of the theoretical research presented in this article is the consideration of advertising as an integral part of communication marketing. The system-forming element of the communication marketing is its creative part, which permeates all its elements, including advertising. Theoretical reflection of the main directions of advertising creativity is of practical importance in terms of branding technologies.

The target of the study is advertising. The scope of the research is advertising as an element of communication marketing system and corresponding creative strategies.

The research is based on the works of Russian and foreign scientists in the field of advertising. Advertising as a multifaceted phenomenon involves a variety of scientific approaches. The basis for the analysis of advertising as an element of socio-cultural system was an interdisciplinary approach using the achievements of theoretical and empirical researches in marketing, sociology, psychology. At the same time, advertising is mainly studied at the micro level of economy as one of the most important marketing tools. The basis of this approach is the conceptual framework, theoretical research and practical analysis of the phenomenon of advertising in marketing. The essence and marketing characteristics of advertising are expressed in the works of such researchers as Beauvais

K., Arena U. (1995), Batra R., Myers, J. D (2004), Burnett, J. (2001), Carter (1998), Ford J. B (2017, 2019), Fulgoni G. M. (2018), Hopkins K. (2005), Kotler F. (2000), Krylov I. (2006), Romat E. V. (2008), Rossiter J., Percy, L. (2000), Sandig et al. (1989), Utkin E. A. (1997), Wells W. et al. (2008), Stoian O. et al. (2018); Ajina, A. S. (2019); Smaliukienė, R.; Monni, S. (2019), etc.

Creative approach in advertising provides effective marketing solutions, forms and supports the unique identity of a brand. Features of creativity in advertising are reflected in publications of Barnard N., Kennedy R., Bloom H. (2002), Dahlen M., Rosengren S., Karsberg J. (2018), Ehrenberg A., Barnard N., Kennedy R., Bloom H. (2002), Imshenetskaya I. N. (2006), Koslow S. (2015), Kovrizhenko M. (2004), Levinson D. K (2007), Ogilvy D. (2005), Reeves B. (1983), Rossiter J. (2000), Sasser S. L., Koslow S., Kilgour M. (2013), Ulyanovsky A. (2003), West D., Caruana A., Leelapanyaler K. (2013), Wood L. A. (2015), etc.

Communicative approach to advertising allows to identify the specifics of its perceptive, interactive aspects, to consider it as an important form of mass communication. Examination of advertising in this aspects is reflected in the works of Adorno T. (2001), Andreeva G. M. (1997), Burnett J. (2001), Eco U. (1998), Hutton G., Fosdick M. (2011), Jayson R., Block M. P., Chen Y. (2018), Harris D. (2003), Sasser S. L., Koslow S., Riordan E. A. (2007), Schivinski B., Christodoulides G., Dabrowski D. (2016), etc.

The basic mechanisms of psychological influence of advertising on the mass consciousness are reflected in the works of these authors: Burton J., Gollins J., McNeely L. E. (2019), Dotsenko E. L. (1996), Lebedev-Lyubimov A. N. (2003), Mamedova N. M. (2005), Myers D. (1997), Sook Kwon Eun, King K., Nyilasy G., Reid L. N. (2019), Varan D. et al. (2018), Verkman (1986), Walls D. M. (2019). Among other views of great interest are psychological theories of Uznadze D. N. (1966) as well as studies of Gestalt psychology of perception (Arnheim R. 2012).

### **3. Advertising as a form of communication marketing**

The concept of communication marketing predetermines such an approach to product promotion management, which involves the complex use of basic, synthetic and creative tools of marketing communications in order to achieve a synergistic effect. Communication marketing permeates all parts of the management chain of marketing, all components of marketing, while creativity performs the integrating function. In modern terms, communication as the essence of marketing is not less important than economic management. Communication creativity is a kind of economic creativity. In economic relations, creativity (the result of intellectual activity, creative activity and innovation) is a two-fold entity. Innovation and creativity increase the efficiency of the enterprise, improve the quality of the product, contribute to the sustainable development of entrepreneurship even in crises. The change of qualitative and quantitative indicators of communication creativity in promotion campaigns can increase their communicative efficiency, save the promotion budget due to the reduction of such a media indicator as “frequency of contacts” and, as a result, increase the economic efficiency of marketing and communication activities, which is especially important in the current market situation.

Advertising is an important element of the communication marketing system. It is a means of creation and distribution of informative-figurative, expressive-suggestive texts. It is addressed to groups of people in order to encourage them to the choice and action that an advertiser needs.

The specificity of advertising as a kind of mass communication in comparison with the personal one is that the advertiser deals with a large number of people whom he or she does not know personally. As a result, it is impossible to control the conditions under which the message will be perceived. There is no instant feedback, which together with the abovementioned traits makes it difficult to get the desired response.



It is necessary to consider advertising and the problem of its effectiveness in a broad socio-cultural context. It performs a variety of social functions: commercial, standard-normative, symbolic, compensatory, psychological, etc. Considering advertising as a special type of communication, we can see how it manifests the three sides inherent in the process of communication: informative; perceptive; interactive.

The informative side of advertising is not only the provision of commercially valuable information (about goods and their use, prices, trade enterprises, services, etc.) Advertising also contains important social information related to the function of socio-cultural identification, that is, self-determination of a person in society – belonging to a group, lifestyle, cultural values. The pragmatics of the language of advertising is that linguistic and non-linguistic forms are a means of evaluation and impact on the socio-cultural environment for the purpose of distribution of consumer products. Advertising message is a complex linguistic phenomenon consisting of iconic, index, symbolic signs. As a result, there are a variety of connotations that form a new semantic space.

As a source of information advertising reflects the characteristics of the socio-cultural environment. In the context of transformation processes, advertising can produce values that reflect new social needs and expand the range of values associated with consumer activity. In a socially dynamic society, when there are intensive processes of social mobility, including the opportunities to move up the social ladder, people may need some “training” in new patterns of consumer behavior. Advertising plays the role of socio-economic orienteer in relation to products and brands corresponding to the new social status. At the same time, advertising activities should be based on the development of advertising goals through using the catching-up strategy. The peculiarity of social psychology is that the members of the group want to catch up, imitate, copy the patterns of life style of a higher social class. Advertising conveys spiritual experience in the form of models of consumer behavior, creates taste preferences of individuals, translates standard life styles. Despite the pragmatic orientation of advertising communication, its effectiveness largely depends on the socio-cultural context. This context largely determines the adequate understanding of the advertising text, the perception of advertising information, the motivation of the target audience, etc. As a kind of common knowledge, advertising contributes to the formation and maintenance of a shared semantic field of society, actualizing the value orienteers of the modern communicative space.

The perceptive side of communication, that is, the processes of perception and understanding, play a role of utmost importance in advertising communication. The specificity of this process in advertising is that the phenomena of intergroup perception occur without direct interaction of the groups themselves. The “second reality” created by advertising replaces psychologically the need to experience the direct interaction with representatives of other social groups. Advertising, thus, can nowadays even mediate the processes of intergroup perception in the communication of different social groups (youth, middle class, elite, gender, etc.).

The processes and structure of perception of advertising, its emotional and mental impact are the subject of psychological research. The artificial environment created by advertising is sometimes difficult to distinguish from reality due to the use of computer technology. However, the objects in advertising are not significant in themselves, but as symbols, which are associated with emotions, desire, any kind of behavior. The importance of perceptual aspects of advertising communication generally increases, as the semantic context of advertising appeal expands due to creativity. However, we should take into account the risky nature of creative advertising. When many incentives are used in advertising (sex, humor, characters, music, etc.), there is a danger of diverting attention to them from the advertised product.

Effective advertising should strive for an adequate perception of the very essence of the advertising message by the audience, and not some supplementary special effects. Therefore, the perception of advertising is associated with people understanding its content. In the process of interpreting the advertising messages there is a danger of distortion, simplification, misinterpretation. When the audience understands the unique characteristics of a brand – only this can be seen as credibility for an advertising campaign.

There are two levels of comprehending advertising that need to be distinguished:

1. Objective level – understanding of the advertising message in accordance with the goals of the advertiser.
2. Subjective level – understanding the message in accordance with one's internal motives, impulses, resonating with the intrapersonal context. The deeper the level of subjective understanding, the more convincing and memorable the advertisement is. One of the productive approaches in understanding the processes of comprehension in advertising as a bearer of the perceptual communication aspect is the methodology of Gestalt psychology. From the point of view of the concept of an organized whole, advertising message and advertising campaign appear not as a set of incentives, but as a unity. People seek to organize and harmonize mental space – to create a favorable image. From a Gestalt perspective, the first few perceived characteristics are important for creating an overall impression. The advertiser should therefore pay attention to making the first impressions of the advertised object. The right organization of a beholder's perception should provide a favorable Gestalt (image) through the psychological effect of filling: in order to achieve mental comfort a person seeks to fill the missing elements to complete the image.

The unfinished figures will be complete by the person's mind.

A well-known phrase being unfinished creates a cognitive impulse to complete it. The audience is thus involved in the process of perception, it does not get the conclusions ready but has to make them, which contributes to memorization. Memorization itself is associated with the process of interpretation of fuzzy stimuli. Advertisements, as a rule, have several components in their structure: image, text, sign. Any of them can lead to confusion and thereby activate the mental activity of the filling. Moderate obscurity can be useful in advertising where it performs the following functions:

- arouses curiosity, attracts attention;
- awakens the desire to reflect;
- makes one study the issue.

The elimination of ambiguity from the stimulus is based on a psychological phenomenon – the human desire to reduce the distinction between the stimuli to their maximum or minimum. In the case where the differences are not too significant, they are perceived as more similar than they actually are and vice versa. In advertising, the principle of "similarity" is used often. For example, it can be advertising of a trademark family, or a transfer of past experience to a new product or trademark (Mamedova N. M. 2005). Lifelikeness – the basis of simplicity – becomes a means of creating an illusory reality, substitution of reality by fiction. A common feature of mass culture and advertising is this kind of lifelikeness. Mass culture has developed a system of visual and expressive means that have been assimilated by advertising practice. These are simple artistic techniques, tested by all the previous development of art, that reflect the universal psychophysiological mechanisms of perception. These are: the use of the average language norm and entertaining plots, satisfying the expectations of the mass audience, the joy of recognition. This is why the law of purity of genres functions in popular culture, these genres being enclosed systems with a certain language and a standard set of subjects. Mass culture in the twentieth century has replaced folklore, which also in the syntactic plan is tough built. V. Y. Propp in the work "The morphology of a fairy tale" (Propp V. Y 2001) shows that it always contains the same syntactic scheme, which can be formalized and represented in logical symbols. Advertising has inherited these features, which, organizing advertising creative text, simplify the process of its perception. Despite the pragmatic orientation of advertising communication, its effectiveness largely depends on its socio-cultural content and aesthetic form.

The interactive side of communication, that is, the interaction of participants in communication is the essential side of advertising. Its purpose is to influence consumer behavior. The presence of delayed feedback can be considered as a manifestation of the specificity of the interactive side of communication in advertising. The influence of advertising is manifested during a long period of time. Advertising is created for the purpose of organizing consumer behavior, and having arisen, it inevitably enters the system of social interaction and thus is integrated into the scheme of social relations. It acts as a catalyst for social relations not only in the economy but

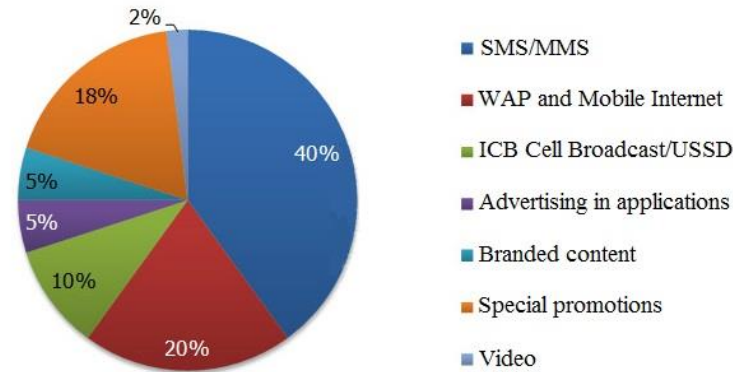
also in society as a whole. All three sides of advertising communication (informative, perceptive and interactive) are closely interrelated.

#### 4. Creativity in advertising

An integral component of the communication marketing system is creativity. The essential characteristics of creativity are originality, non-standard thinking, novelty and, as a result, a high degree of attraction of the attention of consumers, the memorability of the brand and the content of communications. In the system of communication marketing representatives, material carriers of creativity come as the promoted material products, the brand and its attributes, creative and communication strategies, the design, the text, the very space of all communications, characters, communicants, etc. Creativity is the core of the conceptual apparatus of the sphere of communication marketing. The adequately and unambiguously interpreted discourse, the basis of which is a system of concepts built around the category of “creativity”, should be the methodological basis for the development of this research sphere. Such concepts include creative strategy, creative concept, image, product characteristics, product concept, communication space, creative approach, creative method, creative idea, creative technology, copyrighting, creative design, creative production, communication strategy, communication policy, advertising strategy and advertising policy, etc.

Original creative ideas and solutions are tools that can help advertising to stand out, be more memorable and to convey the message in the most effective way to influence an audience (Douglas C. West, George Christodoulides, Jennifer Bonhomme, 2018). Can such pragmatic activity as advertising be elevated to the point of art? The importance of this issue is reflected in the discussions in literature, in the existence of special incentives for the most creative advertising products. Thus, the problem of “Where Marketing Art Meets Marketing Science” was discussed in the pages of Journal of Advertising Research (2016). The Advertising Research Foundation (ARF) annually (since 1994) awards advertising agencies and advertisers for creative developments in their field with David Ogilvy Awards.

Indeed, the main purpose of advertising is to stimulate the sale of goods and services. But this does not mean that there are no conditions for creative self-expression in this sphere, for the concept of creativity characterizes heuristic activity in all spheres of human action. Creativity is an activity that involves the development and application of original solutions and techniques. For example, creative advertising videos synthesize different types of artistic creativity – literary, musical, theatrical, etc., and become an element of mass art. And meanwhile, video advertising, according to J’son & Partners Consulting, is on the average, only 2% of the advertising market (See Fig. 1).

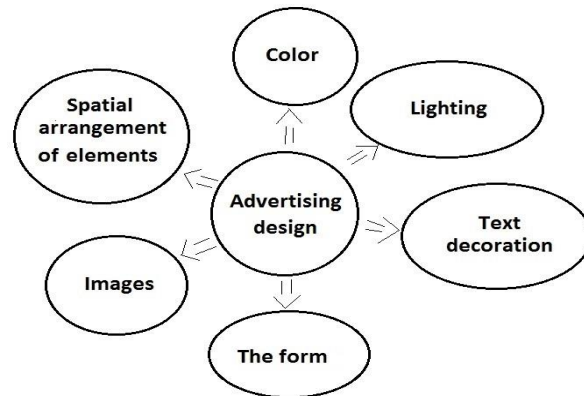


**Figure 1.** The advertising market.  
Source: J'son & Partners Consulting

In the world of total information a consumer is looking for new emotions. He or she agrees to become loyal to the brand only in exchange for entertainment. In modern society, advertising began to perform functions that previously were performed by art.

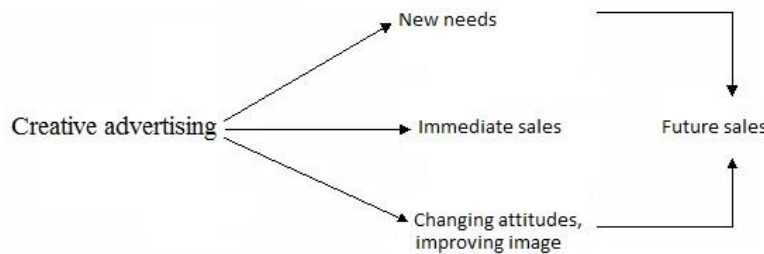
Without skill of representatives of creative professions – a screenwriter (in advertizing – a creator), a director, operators, artists, composers, actors, etc. – the creation of an advertising clip is impossible. For example, many prominent figures of culture and art took part in the creation of commercials: film directors (Federico Fellini – pasta “Barilla”, Wim Wenders – “American Express”, Emir Kusturica – ketchup “Tsigansky – Baltimore”, Nikita Mikhalkov – “Fiat”), artists (Salvador Dali – “AlkaSeltzer”), composers (Jean-Michel Jarre – “Pepsi Cola”, Pavel Karmanov – “Hohland”) and many others.

Undoubtedly, a variety of creative techniques (See Fig. 2) can be used and work well in advertising (Scott Koslow, 2015). But under one condition: they should be used appropriately, originally and with understanding of the purposes and the bases of their use. Two main components characterize truly creative advertising: conceptual and creative ones. The conceptual component is understood as the content part of the advertising message, the basic, deep meaning that the brand conveys to the consumer through advertising.



**Figure 2.** The advertising design.

The functional role of creative advertising is expressed in the impact not only on immediate sales, but also on remote ones (See Fig. 3). The creative component (the idea and form of advertising) appears not earlier than the concept when advertising strategy is clearly formed. The conceptual message is formulated as a task of all advertising activities as a whole and for each advertising message to the individual (Alexander Tevi, Scott Koslow, 2018). For strong, competitive brands, conceptual messages are always connected not just with the product, but with a broader system of sociocultural values. Therefore, they tend to remain unchanged for many years and sometimes decades.



**Figure 3.** The functional role of creative advertising.

Socio-cultural space is filled with a variety of communication processes. Any artifact of the cultural environment acts not only in the hypostasis of its subject-material existence, but also as a carrier of symbolic meaning, forming the semiotic sphere of culture. Artifacts exist in the cultural space as things and as carriers of socially significant information.

Advertising increasingly becomes an integral component of artistic and symbolic space of culture, embodying both these aspects in its manifestation. Advertising is not only an integral element of marketing. As a result of its integration into various social practices of modern civilization, advertising increasingly fits into popular culture. Modern art practices are integrated into the market, being subject to its laws and are transformed in accordance with market demands. Art becomes a vital part of consumer culture, and advertising appears as the most adaptive part of mass culture.

One of the leading trends in modern society is the complexity of the structure of material and spiritual consumption with the dominance of the latter. Advertising as a part of mass culture acts as a means of overcoming this objective contradiction of consumerism. Due to the evolution of advertising practice, modern advertising appears as a complex socio-cultural phenomenon, organically combining pragmatic and aesthetic components. Therefore, in the modern cultural paradigm advertising is one of the ways to overcome the inconsistency of man-made civilization, combining in its artifacts utilitarianism and creativity that in its turn is rooted in spiritual layers of culture.

In advertising practice a variety of techniques of gaming and games are organically used as well as cathartic techniques, artistic and historical allusions. Thanks to a wide range of instruments borrowed from various heuristic practices: artistic, psychological, marketing – advertising creates a specific aesthetics of commodity, a kind of "theater of consumption", introducing new meanings into mass cultural use – meanings that go beyond the narrow framework of pragmatism. Advertising text or image due to its polysemanticism begins to function in culture not only according to the laws of the market, but also as carrier of certain socio-cultural values.

The place of advertising in the communicative space and therefore the role in the communicational marketing is determined by the fact that it is a kind of a center of mass culture. Mass culture arises at the intersection of various spheres – economy, politics, ideology – and assumes the functions of various social institutions. It becomes the primary means of social regulation and sharing of cultural practices in the context of global urbanization and destruction of traditional social connections. The orbit of its influence involves a variety of aspects of human life: from ideological preferences to the style of housing, from clothing to forms of intimacy. Mass culture becomes the main instrument that establishes cultural heritage of modern epoch. It took over part of the traditions of classical realistic art (life-like and attractive to the mass) and part of the functions of religion, which are associated with the harmonization of the mental life of people. Nevertheless, mass culture still is mostly the means of compensation and entertainment – it takes over both elitist and folk culture that both had a strong didactic, educational part in them.

Advertising is not only the most demonstrative part of mass culture, but also its driving force, a way of spreading "modern folklore". Advertising is related to mass culture both genetically and by modes of existence. Among the variety of phenomena and properties that popular culture and advertising share in common, there are several basic ones characterizing the nature of these phenomena.

Advertising is becoming closer to mass culture as a result of the processes of aestheticization of the advertising image. Modern culture reveals its aestheticization in the exit of art beyond the traditional existence, which takes place in different directions: design, environmental practices of modernism, garden design, fashion, advertising (Mamedova N. M., Gavrish V. D., Skatershchikova A. V., Fomina A. S. 2018).

In recent decades, advertising has become a kind of an artifact that combines commercial and artistic components, while functioning as a product of mass replication and consumption. Following general trends of the prevalence of verbal communication over visual one in the postmodernist space (both in consumption and in perception of the world in general), advertising appears as part of the "theater of consumption", as a factor in the formation of "commodity aesthetics". It is subject to the laws of the market and at the same time by its nature is largely similar to mass art.

Many scientists point out the presence of an aesthetic component in advertising communication (Erik Modig, Micael Dahlen, 2019). In particular, R. Kloepper (1980) noted the expediency of using various works of art in advertising, as its artistic component contributes to the development of personal potential. One of the most common ways to create modern advertising is to include images of world art and history in its context and by doing this develop one's own values and ideas about the meaning of life, sometimes replacing spiritual values



with material ones. Experiencing a resemblance of “spiritual hunger”, people begin to strive for ideals, combining such seek with consumption as a way of existence. Following the needs of society, advertising offers people to buy not only a product or service, but also new standards of everyday existence, as a result of constructing a unique aesthetics of consumption. Various visual and expressive means, methods and techniques are used for the aestheticization of the advertising image. This aestheticization of advertising takes place in different directions: the use of gaming techniques, allusions, cultural symbols, etc.

Creativity in advertising involves the strengthening of its artistic component (Charles, E. Young, 2000). The use of cultural and historical allusions is one of the most common methods of aestheticization of advertising. Allusions are a figurative and expressive technique that increases the aesthetic value of an advertising image by referring to or hinting at a known work of art, an element of culture, a fact of history or a famous person and using all this as a basis of imagery. The transformation of the original cultural image as a result of allusions in advertising leads to the endowment of the advertising image with aesthetic value. Therefore advertisements become artifacts. Polysemantic advertising is achieved due to the projection of the elements of an original image on the created advertising image, which allows the consumer to perceive advertising in a broader semantic context. Thus, cultural and historical allusions are used in advertising for utilitarian reasons – for the sake of saving space by creating a polysemantic image with the use of the phenomena of culture and history. At the same time, the transformation of the original image, which occurs as a result of allusive associations, represents the process of its aestheticization. Advertising communication becomes more attractive to the consumer due to this aesthetic component.

The volume of allusive advertising has increased several times over the last years. In the all-encompassing advertising images the goods, works of art, historical personalities are gathered together, creating a specific aesthetics of consumption with its inherent entertainment, even with elements of performance involving consumers in the action. Cultural and historical allusions add irony, comic, play of meanings to the advertising image, emphasizing the self-value of the advertising text and at the same time focusing on the promoted product. Through the principles of a game an advertised object is transformed and a special atmosphere is being developed simultaneously around it that has a subconscious psychological impact on the consumer. As a result, advertising sets no objective facts of reality but only their interpretation.

In this regard, it is important to identify the abilities of a game as a category that describes a modeling of elements of the advertising message. The game due to its main features reduces the level of negative perception of advertising by the audience, increases the average time of advertising contact and the motivation of consumers. The accentuation of the aesthetic component of advertising can already become the basis for the formation of a qualitatively new level of creative advertising strategies. The general cultural trend of the transition from the verbal to the visual reinforces the role of advertising as a means of visualization and translation of new values to the masses by manipulating images of works of art in order to achieve commercial goals. This determines the value of the aesthetic properties of advertising, which occupies a significant place in the information and communication space. Advertising, existing in the same space with art, is more adequately revealed in such phenomena as play, performance, the striking, the shocking. The transformation of the aesthetic component of modern advertising is largely determined by the development of technology. Total visualization, the use of technology in the direction of modeling immersion in a three-dimensional image does not detract from the fact that advertising is primarily a cultural text. Advertising text in the communication space becomes more open to other texts, communicating with them through various intertextual links. Advertising uses a variety of cultural contexts to create a unique image. Such a transformation involves the use of images of play in art. A loss of artistic image of the original cultural context leads to the modification of images of high art in the advertising text. The artistic image acquires additional and sometimes new meanings as a result of the transformation and is separated from the author and the culture that created it to become a component of modern advertising as an

institution of management and stimulation of consumption, a necessary basis for the functioning of modern society.

Thus, the effectiveness of creative advertising solutions is manifested in the fact that they attract attention and arouse interest in their messages, build trust in the brand, shift associations of customers with advertised goods in a positive direction; also they prompt, accelerate and increase sales in general. From all of the above, we can conclude that today, in order for advertising to fulfill its purpose, it must be not just beautiful, bright or funny. It should be unusual, conspicuous, memorable, that is, creative. Talented creativity is able to make advertising memorable, turn it into a kind of artifact that people remember. That is, it affects people for a long time after the end of the advertising campaign, forms a positive attitude to the brand. Good creativity is an emotional program for consumers, and, in fact, is expressed in creating awareness, uniqueness and style inherent only in advertising of some particular product. Creative advertising is one of the most important elements that make an advertising campaign successful. It is a tool of effective communication marketing.

### **5. Myth design in advertising**

The functional role of creativity in advertising is expressed in the focus of attention on the brand, the formation of brand loyalty, which should ultimately lead to the purchase. In conditions of increasing competition for the attention of the target audience, the message becomes effective and efficient if it is built with the help of special techniques and technologies. Such technologies include a design of myths – special communicative field of the brand having mythological features. The sphere of wide application of technology of mythology design is advertising. This explains the high efficiency of advertising messages, their “hypnotic” impact on consumers of different age, gender, social and economic status. Experienced marketers do not just sell goods and services, but create competitive brands that “sell” these goods and services themselves. Creative advertising with an exciting history rooted in cultural archetypes creates an attractive brand with unique traits. «We are storied creatures. Our life is a story. We communicate through telling and listening to stories. Strong, enduring brands use the power of story and/or mythic images to create (or represent) mytho-symbolic brand building worlds... Storied brands come to represent appealing mytho-symbolic worlds, with their own mythology, symbolism, and values, that work to maintain and reinforce the brand's identity, personality, and emotional connection with the consumer» (Sal Randazzo 2006). Through the use of myth designing technology, advertising images in the minds of individuals merge into a single whole and are perceived as the only possible picture of the world, creating a unique brand identity.

The appeal to the unconscious structures of both individual and collective psyche, the expression of mass taste and mass subconscious desire gives the brand credibility. Advertising excites vague but very sensitive impulses for social consciousness, which is determined by our subject's mythological side. Symbolic, mythical and creative role of advertising consists in giving the product a certain cultural, social values, a new fictional sense. Modern mythology is different from the archaic one. But still, the analysis of the features and mechanisms of action of archaic myths allows us to understand the socio-cultural projections of modern myth-making in advertising.

Archaic myth, or proto-myth was mostly a non-verbal, visually effective form of learning. The reflective function of the cognitive process is manifested in the ritual and the myth not so much, as the interpretive one, associated with the transfer of the subject of knowledge, oneself in the place of another, with empathy and imitation. In the myth and ritual man commits an act of participation, introduction, projection of oneself in the miraculous power of the ancestors. Mythical images are caused not only by external physical powers, but also by internal physiological conditions and mental archetypal structures of a person (according to C. Jung). Archaic thinking was a psychological projection of people's own ideas on the world, which rebuts rational thinking. Mythical thinking is not operational, formally logical, but probabilistic in nature, it is characterized by experimental and empirical analyticity, lack of developed reflexive-critical attitude, circumvention of contradiction (Cramphorn,

Spike 2006). The specificity of primitive logic is that it reaches the goal not directly, but in a roundabout way ("Bricolage"), shuffling, rearranging the existing symbolic elements, highlighting opposites ("binary oppositions").

Sensory-emotional, irrationally physiognomic attitude of primitive man to the world, awareness of the dangers of some phenomena and things was obviously one of the reasons for the prohibitions, regulations, rituals, taboos as prerequisites for the formation of primitive culture, i.e. the formation of human society. Myths, rites and rituals in the archaic society became the forms of correlation between the mythical subject and the samples of primitive culture, they prescribed certain norms and values. In primitive society, the foundations of human civilization are laid, almost everything that will look absolutely natural for hundreds of future generations (family, power, norms and rules of behavior, etc.) is invented here. Taboos, prohibitions, regulations begin to play the role of the collective will, the emerging morality as a form of self-consciousness of society. Myths acted as a "means" of maintaining the natural and social order, affirmed the system of values adopted in this society, sanctioned certain norms of behavior. Therefore, myth is not just an allegorical, symbolic story or narrative. It is experienced by the mythical consciousness like the oral "Holy Scripture", as a reality that affects the world and man.

The protective function of myth and ritual was manifested not only in the interaction of humans with the world, but also with themselves. The myth was a synthesis of the unconscious with consciousness in the cognitive act, it overcame the danger of the contradiction of consciousness with the unconscious archetypal basis. This was the healing essence of rituals, ceremonies, rites, worship, which were aimed at preserving traditions as a means of protection inherited from ancestors.

Thus, the archaic myth was an axiological imperative that determined the behavior of the individual within the framework of certain prohibitions, taboos aimed at introducing the miraculous power of ancestors, heroes, spirits of people and things, their favorable and not destructive manifestation. This determined the socio-cultural aspect of mythical thinking, its role and importance in the formation and development of society, preservation and transmission of traditions. Myth was also a means of human inclusion in social reality, its construction and maintenance, not only as a specific form of reflection of nature or the expression of the psyche, but also as the projection of emerging social relations.

Features of mythical thinking allow us to understand some of the peculiarities of perception and impact of advertising. In advertising as well as in myth, the interpretive function of the cognitive process leading to subjective experience and imitation is extremely important. Some models of cognitive processes in advertising are also characterized by experimentally empirical analyticity, lack of reflexive-critical thinking, avoidance of contradiction. The effect of advertising occurs not directly, but in a form of "bricolage", through the rearrangement of various symbolic elements, which also makes advertising somewhat close to the primitive thinking. The synthesis of the unconscious and the conscious in the cognitive act that is allowing to avoid their hostile opposition is another characteristic of the myth and it also reveals another facet of advertising influence. We can agree with Roland Barthes that the purpose of myth is to purify experience from anything accidental. Myth makes things harmless, finds their justification in the eternal and unchanging nature, gives them clarity. It forms a world without contradictions, because there is no depth in it, and places it in front of our eyes in all its evidence, serene clarity when it seems that things mean something in themselves (Barthes R., 1989).

The ancient myth was, as noted above, a means of sociocultural regulation and translation of cultural experience. Popular culture and advertising, as its most dynamic sphere, inherited these functions of myth. Modern mythology covers a wide range of social, economic and even political phenomena, beliefs, values, prejudices, stereotypes and various cognitive processes. Repeatability is a facet of the mythical reflection of the world that is fancifully manifested in modern culture. Archaic myth is narrative and descriptive, while modern myth is visual – largely due to the cinema, television and advertising it acquires the reliability of the perceptible image. It comes as the

actualization of the archetype in various symbolic forms. In the words of M. McLuhan (McLuhan M. 1964) mass culture is to immerse people into the world of "silence and the unconscious".

The creation of modern myths is based on the technology of myth design, using the features of mythological thinking, imagery, emotional relevance of consumer psychology. It allows to organically combine the needs of marketing and deep hidden phenomena of human psychology. The myth in relation to myth design technology can be the tool, the result or the source material. Myth design allows experts in advertising, designers of communications to use effective tools in marketing communications, capable of enriching the content and forms of marketing and advertising.

Principles of myth design form a system, which includes:

- the principle of formation of the communicative subject field, in which there is a synthesis that combines communication,
- cognitive-conceptual processes of consumers,
- the principle of unity of marketing strategy and designer's creativity. It appears as an effective way of modeling marketing, creative communications. The special importance of this technology is manifested in many spheres of advertising of goods and services: educational services, cars, health care, tourism and other fields of activity.

## Conclusions

The objective need for effective marketing management as well as improving the competitiveness of various organizational structures of business and sustainable entrepreneurship predetermine the importance of theoretical research and practical implementation of effective approaches to the creation of advertising. Advertising is an integral part of the communication marketing system, which is based on creative strategies. The modern advertising paradigm includes pragmatic and artistic aspects. Creative approach to advertising allows to realize this phenomenon's dual nature. The pragmatics of advertising is manifested in its main goal – to stimulate the consumption of goods and services. At the same time, one of the leading trends in the development of advertising is the process of aestheticization, which occurs in different directions: the use of gaming techniques, allusions, cultural symbols, etc. The effectiveness of advertising is manifested in a wide socio-cultural context. Advertising performs various social functions: entrepreneurial, normative, symbolic, compensatory, psychological, etc. In this article we also analyze the characteristics of informative, perceptual and interactive processes in advertising communication from the point of view of marketing, psychological, and communicative approaches. The significance of myth design as an effective technology of marketing in general and branding in particular is also examined in this article. The essence of myth design is to create such a communication space for the brand, which due to archetypes synthesizes cultural factors and individual phenomena of consciousness in a united metasystem. In the light of the features of mythological thinking, the nature of advertising myth-making is a way of giving a product some cultural and social value, a new fictional meaning and increasing of its commercial attractiveness and the creation of a specific uniqueness of the brand. In general, it seems to us that in the context of the universal trend of transition from verbal to visual, the role of advertising increases as a means of visualization and translation of economic and socio-cultural values.

## References

- Adorno, T. 2001. *The Authoritarian Personality*. Moscow: Silver threads. 416 p.
- Ajina, A. S. 2019. The perceived value of social media marketing: an empirical study of online word-of-mouth in Saudi Arabian context, *Entrepreneurship and Sustainability Issues* 6(3): 1312-1327. [https://doi.org/10.9770/jssi.2019.6.3\(32\)](https://doi.org/10.9770/jssi.2019.6.3(32))
- Anatomy of advertising image. 2004. *Under the General editorship of A.V. Ovruckogo*. St. Petersburg: Peter. 224 p.

- Andreeva, G. M. 1997. *Social psychology*. Moscow: Aspect Press. 237 p.
- Arnheim, B. 2012. *Art and visual perception*. Moscow: Architecture-S. 302 p.
- Angel, R. J., Angell, C. 2013. More than Just "Snap, Crackle, and Pop", *Journal of Advertising Research* 53(4): 377-390. <https://doi.org/10.2501/JAR-53-4-377-390>
- Batra, R., Myers, J. D. 2004. *Advertising management*. Moscow; St. Petersburg: Publishing house "William". 568 p.
- Bart, B. 1994. *Selected works: Semiotics: Poetics*. Moscow: Progress. 616 p.
- Burnett, J. 2001. *Marketing communications. Integrated approach*. St. Petersburg: Peter. 860 p.
- Burton, J. L., Gollins, J., McNeely, E. Linda, W., Danielle M. 2019. Revisiting the Relationship between Ad Frequency and Purchase Intentions, *Journal of Advertising Research* 59(1): 27-39. <https://doi.org/10.2501/JAR-2018-031>
- Beauvais, K., Arena, U. 1995. *Modern advertising*. Togliatti: Publishing House Dovgan 704 p.
- Bezveselnaya, Z. 2018. 'The economic man' in modern social studies and the problems of forming management culture. Bulletin of the Russian Economic University named after G.V. Plekhanov 1(97): 210-214.
- Calder, B. J., Isaac, M. S., Malthouse, E. C. 2016. How to Capture Consumer Experiences: A Context-Specific Approach To Measuring Engagement, *Journal of Advertising Research* 56(1): 39-52. <https://doi.org/10.2501/JAR-2015-028>
- Carter, M. 1998. *Effective advertising: a Guide for small businesses*. Moscow: BIZNES-INFORM. 243 p.
- Cramphorn, S. 2006. Blink: The Power of Thinking without Thinking / Strangers to Ourselves: Discovering the Adaptive Unconscious, *Journal of Advertising Research* 46(1): 135-138. <https://doi.org/10.2501/S002184990600016X>
- Dahlen, M., Rosengren, S., Karsberg, J. 2018. The Effects of Signaling Monetary and Creative Effort in Ads, *Journal of Advertising Research* 58(4): 433-442 <https://doi.org/10.2501/JAR-2018-013>
- Dahlén, M., Rosengren, S., Törn, F. 2008. Advertising Creativity Matters, *Journal of Advertising Research* 48(3): 392-403. <https://doi.org/10.2501/S002184990808046X>
- Dmitrieva, L. M. 2009. *Social advertising*. Moscow: YUNITI-DANA. 271 p.
- Dotsenko, E. JI. 1996. *Psychology of manipulation*. Moscow: LLP "Cero". 342 p.
- Ehrenberg, A., Barnard, N., Kennedy, R., Bloom, H. 2002. Advertising As Creative Publicity, *Journal of Advertising Research* 42(4): 7-18. <https://doi.org/10.2501/JAR-42-4-7-18>
- Eco, U. 1998. *Missing structure. Introduction to semiology*. St. Petersburg 382 p.
- Fay, B., Larkin, R. 2017. Why Online Word-of-Mouth Measures Cannot Predict Brand Outcomes Offline, *Journal of Advertising Research* 57(2): 132-143 <https://doi.org/10.2501/JAR-2017-021>
- Ford, J. B. 2017. What Do We Know About Mobile Media and Marketing? *Journal of Advertising Research* 57(3): 237-238. <https://doi.org/10.2501/JAR-2017-032>
- Ford, J. B. 2018. What Do We Know About In-Store Marketing?, *Journal of Advertising Research* 58(2): 131-132. <https://doi.org/10.2501/JAR-2018-020>
- Ford, J. B. 2019. What Do We Know About TV in the Digital Age?, *Journal of Advertising Research* 59(1): 1-2. <https://doi.org/10.2501/JAR-2019-006>
- Fulgoni, M. G. 2018. How Limited Data Access Constrains Marketing-Mix Analytical Efforts, *Journal of Advertising Research*. 58(4): 390-393. <https://doi.org/10.2501/JAR-2018-046>



- Harris, D. 2003. *Psychology of mass communications*. Moscow: OLMA-PRESS, St. Petersburg: praym. 350 p.
- Hopkins, K. 2005. *Advertising: a scientific approach*. Moscow: Alfa-press 80 p.
- Hutton, G., Fosdick, M. 2011. The Globalization of Social Media, *Journal of Advertising Research* 51(4): 564-570. <https://doi.org/10.2501/JAR-51-4-564-570>
- Imshenetskaya, I. N. 2006. *Creative in advertising*. Moscow: Rip-holding. 176 p.
- Ivlev, V.Y., Barkova, E.V., Ivleva, M.I., Buzskaya, O.M. 2016. Environmental approach to the study of the modern stage of information society development: Research prospects. *International Journal of Environmental and Science Education* 11(16): 9113-9124.
- J'son & Partners Consulting.  
<https://go.mail.ru/search?fm=1&q=J%E2%80%99son%20%26%20Partners%20Consulting&sf=503>
- Kietzmann, J., Paschen, J., Treen, E. 2018. Artificial Intelligence in Advertising, *Journal of Advertising Research* 58(3): 263-267. <https://doi.org/10.2501/JAR-2018-035>
- Kloepfer, R. 1980. *The dialogical in everyday language and literature*. Dialogue research. Institute for German language. Dusseldorf. 313-333.
- Koslov, S. 2015. I Love Creative Advertising, *Journal of Advertising Research* 55(1): 5-8. <https://doi.org/10.2501/JAR-55-1-005-008>
- Kotler, F. 2000. *Basics of marketing*. Moscow: Progress 736 p.
- Kovrizhenko, M. 2004. *Creative in advertising*. St. Petersburg: Peter 253 p.
- Krylov, I. V. 2006. *Theory and practice of advertising in Russia*. Moscow: Center 312 p.
- Kwon, E., S. King, K.W., Nyilasy, G., Reid, L. N. 2019. Impact of Media Context on Advertising Memory, *Journal of Advertising Research* 59(1): 99-128. <https://doi.org/10.2501/JAR-2018-016>
- Kozmin, V. 2015. Axiological approach to the analysis of social priorities of the economy of modern society. *Bulletin of the Academy* 1 (42): 212-215.
- Jayson, R., Block, M. P., Chen, Y. 2018. How Synergy Effects of Paid and Digital Owned Media Influence Brand Sales, *Journal of Advertising Research* 58(1): 77-89 p. <https://doi.org/10.2501/JAR-2018-011>
- Lebedev-Lyubimov, A. N. 2003. *Psychology of advertising*. St. Petersburg: Peter 368 p.
- Levinson, D. K. 2007. *Guerrilla creativity. Create a marketing virus and infect the consumer with it*. Moscow: EKSMO 320 p.
- Mamedova, N. M. 2005. *Psychology in advertising*. Moscow: Russian University of Trade and Economics 54 p.
- Mamedova, N. M., Gavrish, V. D., Skatershchikova, A. V., Fomina, A. S. 2018. Sports in social practice universe of modern civilization, *Theory and Practice of Physical Culture* 1: 16-18.
- McLuhan, M. 2003. *Understanding media: extension of man*. Zhukovsky: Kuchkovo field 462 p.
- Myers, D. 1997. *Social psychology*. St. Petersburg: Peter 684 p.
- Ogilvy, D. 2005. *Ogilvy on advertising*. Moscow: Eksmo 232 p.
- Potebnya, A. A. 1999. *Thought and language*. Moscow: Labyrinth 300 p.
- Precourt, G. 2013. What We Know About Creativity, *Journal of Advertising Research* 53(3): 238-239. <https://doi.org/10.2501/JAR-53-3-238-239>



- Propp, V. 1998. *The morphology of a fairy tale*. Moscow: Labyrinth 143 p.
- Reeves, B. 1983. *Reality in advertising*. Moscow: North 116 p.
- Romat, E. V. 2001. *Advertising*. St. Petersburg: Peter 496 p.
- Rossiter, J. R., Percy, L. 2000. *Advertising and promotion*. St. Petersburg: Peter 651p.
- Sandig, I., Fryburger, V., Rotzoll, K. 1989. *Advertising: theory and practice*. Moscow: Progress 538 p.
- Sasser, L. Sh., Koslow, S., Kilgour, M. 2013. Matching Creative Agencies with Results-Driven Marketers, *Journal of Advertising Research* 53(3): 297-312. <https://doi.org/10.2501/JAR-53-3-297-312>
- Sasser, Sh. L, Koslow, S., Riordan, E. A. 2007. Creative and Interactive Media Use by Agencies: Engaging an IMC Media Palette for Implementing Advertising Campaigns, *Journal of Advertising Research* 47(3): 237-256. <https://doi.org/10.2501/S0021849907070286>
- Saussure, F. 2000. *Notes on General linguistics*. Moscow: Progress 280 p.
- Schivinski, B., Christodoulides, G., Dabrowski, D. 2016. Measuring Consumers' Engagement with Brand-Related Social-Media Content, *Journal of Advertising Research* 56(1): 64-80. <https://doi.org/10.2501/JAR-2016-004>
- Smaliukienė, R.; Monni, S. 2019. A step-by-step approach to social marketing in energy transition, *Insights into Regional Development* 1(1): 19-32. [https://doi.org/10.9770/ird.2019.1.1\(2\)](https://doi.org/10.9770/ird.2019.1.1(2))
- Southgate, D. 2017. The Emergence of Generation Z and Its Impact in Advertising, *Journal of Advertising Research* 57(2): 227-235. <https://doi.org/10.2501/JAR-2017-028>
- Stoian, O., Polozova, T., Didenko, E., Storozhenko, O., Moskvichova, O. 2018. Strategies of interaction with a consumer within the marketing product policy, *Entrepreneurship and Sustainability Issues* 6(2): 1018-1027. [http://doi.org/10.9770/jesi.2018.6.2\(36\)](http://doi.org/10.9770/jesi.2018.6.2(36))
- Uznadze, D. N. 1966. *Psychological research*. Moscow: Science 449 p.
- Ulyanovsky, A. 2003. *Social myth as a brand: philosophical anthropology, aesthetics on the boundaries of prohibition*. Monograph in 2T. T. 1 St. Petersburg: rose of the World 234 p.
- Utkin, E. A. 1997. *Advertising business*. Moscow: EKMOS 272 p.
- Verkman, K. J. 1986. *Trademarks: Consciousness, psychology, perception*. Moscow: Progress. 520 p.
- Varan, D., Lang, A., Barwise, P., Weber, R., Bellman, S. 2015. How Reliable Are Neuromarketers' Measures of Advertising Effectiveness? *Journal of Advertising Research* 55(2): 176-191. <https://doi.org/10.2501/JAR-55-2-176-191>
- Wells, W., Moriarty S., Burnett, John. 2008. *Advertising: principles and practice: Marketing for professionals*. St. Petersburg: Peter 568p.
- West, D., Caruana, A., Leelapanyalert, K. 2013. What Makes Win, Place, or Show? *Journal of Advertising Research* 53(3): 324-338. <https://doi.org/10.2501/JAR-53-3-324-338>
- West, D. C., Christodoulides, G., Bonhomme, J., 2018. How Do Heuristics Influence Creative Decisions at Advertising Agencies? , *Journal of Advertising Research* 58(2): 189-201. <https://doi.org/10.2501/JAR-2017-056>
- White, Alisa, Smith, Bruce L. 2001 Assessing Advertising Creativity Using the Creative Product Semantic Scale, *Journal of Advertising Research* 41(6): 27-34. <https://doi.org/10.2501/JAR-41-6-27-34>
- Wood, Leslie A., Poltrack, David F. 2015. Measuring the Long-Term Effects of Television Advertising, *Journal of Advertising Research* 55(2): 123-131. <https://doi.org/10.2501/JAR-55-2-123-131>

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## THE ROLE OF FOREIGN DIRECT INVESTMENT IN THE ECONOMY OF SLOVAKIA\*

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**Abstract.** In the paper, we point out the role of FDI in the Slovak economy, analyze their status in the period from 2010 to 2015, suggest their regional and branch aspect. FDI is an effective form of international business that complements lack of internal resources and contributes to economic growth. As competition of FDI is very strong, it is important to create appropriate economic, political and legislative conditions that the economy is capable of creating for foreign investors. The state of FDI in the Slovak economy has been gradually increasing since 2010, but its large sectoral and regional imbalances appear to be unfavorable. The impact of FDI on GDP development indicates that each FDI unit contributes to economic growth, respectively GDP growth; it affects employment and contributes to the solution of unemployment. The problems of FDI in the Slovak economy are one-sided positioning in the automotive industry and at the same time their location in the developed regions, i.e. in the area of Western Slovakia.

**Keywords:** foreign direct investment; portfolio investment; economic growth; GDP; unemployment; regional development

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## 1. Introduction

Foreign direct investment (FDI) is generally regarded as an effective form of international economic relations and international business and can directly contribute to a significant increase in investment resources in each economy. The problem of individual economies is the lack of internal resources and therefore FDI is an indispensable complement to them, which increases economic growth, affects employment, improves technological management know-how and positively affects other areas of the economy. It is evident that in FDI companies, for example, higher labor productivity per worker, FDI bring more effective operation of companies and regions, and also indirectly in the form of spill-overs effects, i.e., in the form of positive externalities. The competition for FDI is very strong and limited, so it is important to create appropriate economic, political and legislative conditions to attract foreign investors and increase their inflow. Even Slovakia is a country that needs external resources and therefore needs to improve its investment attractiveness.

Many authors deal with this issue from different perspectives, pointing out the role of FDI in the economy as well as the form of realization. The major subjects through which FDI enter the economy include multinational corporations, their activities and their impact on the economy are both positive and negative as reported by the authors, e.g. R.E. Caves (2007), J.H. Dunning (2012) and S. Ferencíková (2013), M. Tvaronavičienė et al. 2018, Z. Zeibote et al. 2019. FDI is significant in terms of overwhelmingly positive consequences. The role of vertical and horizontal foreign investment on the example of several economies and the intensification of entrepreneurial activities emphasize, for example, J. Hardy, M. Pollakova Fifeckova and M. Sass (2011). From Slovak authors who are investigating FDI in terms of their impact on economic growth, unemployment, other macroeconomic indicators, resp. their influence on the safety of the population or economy are T. Dudáš (2010), M. Fabuš (2014, 2015), M. Fabuš, M. Csabay (2018), L. Shuyan, M. Fabuš 2019; M. Kováč (2016) and L. Kabát, S. Filip and Ľ. Filipová (2016).

Another possible approach to investigating FDI is the decision of foreign investors to locate them in a particular economy or region. In this context, it is necessary to examine the investment attractiveness of the economy, the quality of the business environment, and to observe the individual determinants affecting the decisions of foreign investors M. Fabuš (2017), M. Lincényi and M. Fabuš (2017). The entry of foreign investments also affect socio-economic relations in economies, for example by influencing the labor market, employment, and often lead to the growth of migratory movements, especially in economies that imply economically more favorable conditions. These facts are reflected, for example in I. Dudová and S. Polonyová (2017), further article of I. Dudová and V. Stanek (2016).

In emphasizing the role of FDI in the economy, it is necessary to see their impact on regional development and the reduction of regional disparities. It can be said that the entry of a major investor increases regional GDP, increases employment and improves the overall conditions of business entities in terms of improving managerial skills, organizational structure, qualification and education of labor forces, and so on. K. Stachová and Z. Stacho (2016, 2017), but also V. Gozora and M. Hudáková (2014).

The study of the FDI impact on the economy in Slovakia's conditions was based on publications that examine the theoretical approaches to FDI, their practical implementation from a regional and sectoral point of view and their impact on selected macroeconomic indicators J. Táncošová and A. Slaný (2004), J. Táncošová and S. Švecová (2012) and J. Táncošová (2012).

Our intention is to find the answer to the research questions: What is the impact of FDI entry on the economy of Slovakia in the period and do they contribute to economic growth and reduce unemployment? Is it possible to achieve better regional and sectoral directions for the FDI to Slovakia, which are the main causes of this situation in the period under review?

## 2. Development of FDI inflow into Slovakia and economic growth

When we come out from the FDI status to the Slovak economy, we see (Table 1) that there is a slight fluctuation in the development, which means the alternation of the periods with a higher but also lower inflow of FDI. Significantly, the FDI inflow was marked by the time of the last global recession, which affected the behavior of foreign investors whose behavior became more cautious. This period is already over and from 2010 until now there is a gradual increase in the volume of FDI and an overall revival of the movement of long-term capital.

**Table 1.** Status of FDI to the Slovak economy in 2010 – 2015 (mil. Eur)

Years	Equity participation and reinvested capital	Other capital	In sum
2010	31,793	5,871	37,665
2011	34,021	6,151	40,173
2012	34,131	7,648	41,779
2013	35,249	6,822	42,071
2014	34,039	6,938	40,969
2015	35,917	6,347	42,265

Source: Based on <https://www.nbs.sk/en/statistics/balance-of-payments-statistics/foreign-direct-investment>

FDI we mention in the structure the equity participation and the reinvested capital, the other capital and the overall state. Equity participation means monetary and non-monetary investor deposits that are invested in basic capital and include equity-shares. Reinvested earnings are the proportion of direct investors in proportion to the equity participation and other capital includes corporate credit operations.

Economic growth is generally defined as the increase in basic macroeconomic variables over time, and is most often expressed by the increase in Gross Domestic Product (GDP). GDP development is affected by the ability of the economy to make full use of capital and human resources, especially internal. In the absence of internal resources, they are most often supplemented by external, mainly foreign direct investment. In the previous section, we have listed the FDI status in the Slovak Republic since 2010 and we are now showing the development of GDP in the same time period. GDP developments were also influenced by the global economic and financial recession, which was fully reflected in Slovakia in 2009, which led to a lower inflow of FDI and a drop in GDP. In 2008, the level of GDP was 68,322.5 million. EUR and in 2009 it amounted to EUR 63,818.5 million, only 93.4% (compared to the previous year). From 2010, the recovery and gradual growth of GDP in Slovakia took place. The evolution of selected macroeconomic indicators is shown in Table 2.

**Table 2.** Development of GDP, GDP/per capita, unemployment in Slovak republic in 2010 – 2015

Years	GDP in current prices in mil. Eur	Change to the previous year - index	GDP per capita in Eur	Unemployment in %
2010	67 577,3	105,6	12 450	14,4
2011	70 327,2	104,5	13 080	13,5
2012	72 703,2	102,9	13 450	14,0
2013	74 169,9	102,0	13 700	14,2
2014	76 087,8	102,6	14 010	13,2
2015	78 896,4	103,7	14 510	11,5

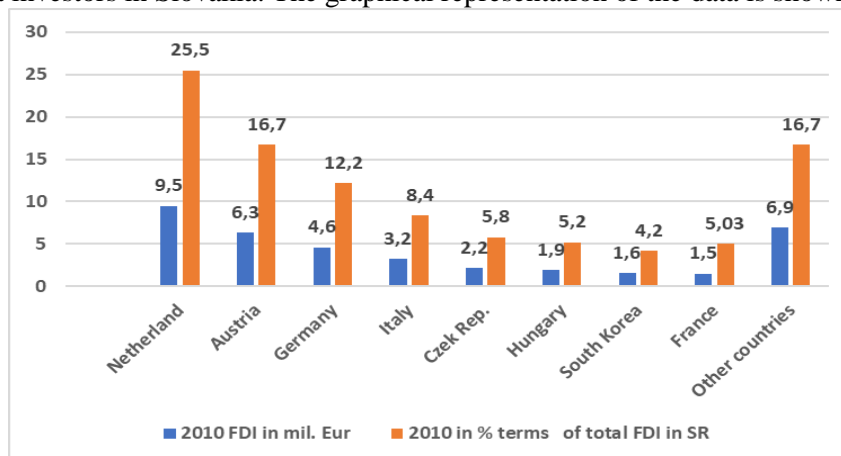
Source: Statistical office of SR [www.statistics.sk](http://www.statistics.sk)

From the point of view of the reached indicators, it can be said that economic growth started to recover in 2010, which was reflected in GDP growth, although in 2011-2012 it was very mild and more or less stagnant. The more favorable development is only happening from 2014, which is maintained until today. This was also reflected in an increase in GDP per capita as well as the gradual decline in the unemployment rate, which fell below 10% in 2016 (9.6%) and is still decreasing.

Comparing GDP and FDI developments in the Slovak economy, there is a certain correlation between these indicators. We can say that any increase in FDI also results in an increase in GDP (not directly in proportion) and consequently also in the fall in unemployment. Of course, we have to realize that other effects and factors in the economy also have a multiplier and acceleration principle, and their manifestations in the economy show a certain lag rather than directly proportional. From the point of view of conclusions, we can state (in connection with the first research question) that without FDI, the economic growth in Slovakia in individual years could not be achieved, although with some additional effect. This means that each FDI unit has some effects in economic growth, but it will also be reflected in a reduction of unemployment.

### 3. Territorial, sectoral and regional aspect of FDI development in Slovakia

Let us look further at the territorial aspect of FDI development, comparing the baseline for 2010 to 2015, which is the last year with the final data published by the National Bank of Slovakia (hereinafter NBS). We can state that the largest investors were the Netherlands, Austria and Germany. Of the total FDI in 2010 of 37.7 million euro participated in percentage terms respectively: 25.5%, Austria 16.7%, Germany 12.2%, and Italy 8.4%, Czech Republic 5.8%, France 5.03%, Hungary 5.2% and South Korea 4.2%. From the total FDI in 2010 (€ 37.7 million), up to 83% comes from these seven countries. As shown in the figure below, we see FDI in millions EUR and the percentage of largest investors in Slovakia. The graphical representation of the data is shown in Figure 1.



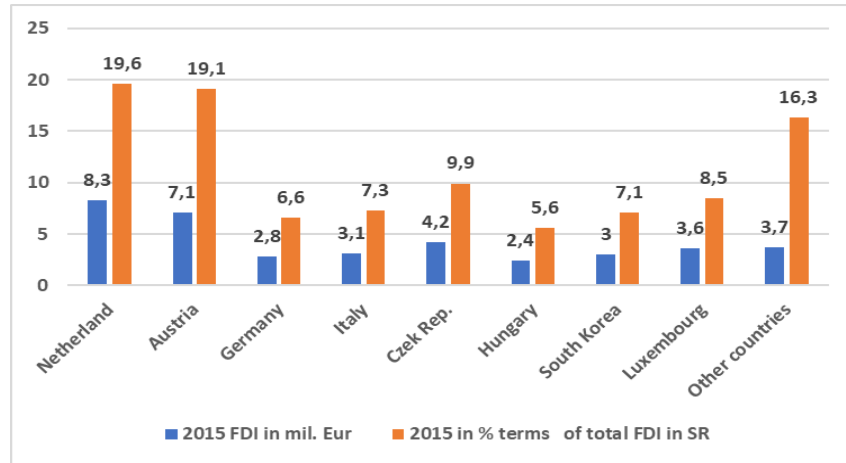
**Fig.1.** FDI by country of origin in 2010  
FDI inward positions in SR/2010/countries

Source: Statistics of the Balance of Payments - [www.nbs.sk](http://www.nbs.sk)

In 2015 from the total FDI 42.3 mil. euros were the largest foreign investors in percentage terms in the following countries: the Netherlands 19.6%, Austria 19.1%, Czech Republic 9.9%, Luxembourg 8.5%, Germany 6.6%, Italy 7.3%, South Korea 7.1% and Hungary 5.6%. Compared to 2010, Luxembourg was among the most significant investors, and the share of traditional countries France and Germany fell. Its



position has been strengthened by the Czech Republic and South Korea. Of the total FDI in 2015, about 84% comes from these eight countries. The graphical representation of the data is shown in Figure 2.



**Fig.2.** FDI by the country of origin in 2015  
FDI inward positions in SR/2015/countries

Source: Statistics of the Balance of Payments - [www.nbs.sk](http://www.nbs.sk)

The FDI sectoral trend in 2010 is even more unevenly distributed, and in general, the overall FDI is placed in a relatively small number of industries where industry, financial and insurance, and electricity, gas and service supply have the largest share of the overall FDI they are wholesale and retail. The overview of the sectors with the largest proportion of FDI is shown in Table 3.

**Table 3.** Status of FDI in SR by economic sectors in 2010 and 2015  
FDI inward positions in SR/Economic activity in 2010 and 2015

Economical sectors	FDI in mil. Eur. 2010	% proportion on whole FDI in 2010	FDI in mil. Eur. 2015	% proportion on whole FDI in 2015
Industrial production	12,9	34,2	14,1	33,3
Electricity and gas supply	5,7	15,1	1,8	4,2
Wholesale and retail	3,7	9,8	3,8	9,0
Financial and insurance activities	8,1	21,9	10,3	24,3
Real estate activities	2,1	5,6	3,0	7,1
Information and communication	1,6	4,2	2,2	5,2
Expert, scientific and technical activities	1,4	3,7	1,5	3,5

Source: Statistics of Balance of Payments - [www.nbs.sk](http://www.nbs.sk)

If we compare the baseline for 2010 to 2015, we can say that FDI flows to approximately the same number of sectors and the rest remain less represented by foreign investors. These are traditional foreign investors and countries of origin of FDI, which place their investments in traditional industries. These do not change significantly, and investors do not even change their behavior and go where they have the same background and fulfilled the economic and other conditions.

Large disproportions are also in the regional FDI deployment, essentially since the creation of the independent SR in 1993. If we come out from the available information (according to the NBS) we can state that the localization of FDI according to individual regions of Slovakia is markedly unilateral and unevenly distributed. In the

analyzed period 2010-2015, the western Slovakia regions obtained most of the FDI and, for example, in 2014 it was up to 83.2% of all FDI in the SR. The highest share was recorded in the Bratislava region by 69.2%, followed by the Trnava region with a share of 4.4%, the Trenčiansky region with 5.6% and the Nitra region by 4.0%. We can say that Bratislavský kraj strongly dominates throughout the period under review. In comparison to the other regions, it is caused by the best economic conditions, the relatively best-developed infrastructure, the availability of a workforce with a relatively high level of education and a suitable structure, such as, for example, the proximity of the Vienna Airport and many others.

Other regions have a much lower inflow of FDI and, for example, Central Slovakia gained only 8.4%, of which Zilina region 6.6% and Banská Bystrica region 1.8%. Even smaller inflows were registered by the regions of eastern Slovakia, to which only 8.2% of all FDI was in total. According to individual regions, in Košice region it was 6.6% and in the Prešov region only 1.6%. The causes are clear and the regions in Central and Eastern Slovakia belong to the least developed regions over the long-term and are significantly lagging behind the regions in the west of Slovakia. It is a state that does not significantly change.

On the basis of the previous investigation, we found (the second research question) that the entry of foreign investors can be influenced by the constant improvement of economic, legislative and other conditions. Also, the better the starting conditions in the region, the more FDI there. If suitable conditions are created (e.g. in the Bratislava region) also in terms of the structure and qualification of the workforce, it can attract foreign investors. Just a skilled workforce is becoming a problem in several regions, especially in those where the FDI are located in the automotive industry and related industries.

This makes it clear and the conclusion is that regions that are able to create better conditions and attract more foreign investors are more advanced and those with worse conditions are lagging behind in all areas. As in less developed regions, there are a number of disadvantageous long-standing factors that do not allow sufficient room for foreign investors to develop. These include, in particular, determinants conditioning the development of the investment environment, from macroeconomic conditions to less developed infrastructure or inappropriate workforce structure. Subsequently, they mean lower regional GDP growth, higher unemployment and insufficient room for foreign investors, and much more.

## **Conclusions**

When comparing the FDI status and its role in the economy of Slovakia it can be said that obstacles have been overcome after the last global recession and that the entry of foreign investors has risen globally but also in Slovakia. This was also reflected in an increased inflow of FDI into the economy of Slovakia and reflected also in GDP growth and the reduction of unemployment. Negative seems to be its insufficient total volume to the total needs of the Slovak economy and especially the uneven entry into individual branches, but also in the regional location within Slovakia. Although it is welcome to enter industrial production, its unilateralism (especially in the automotive industry) is becoming a risk especially in situations such as economic and financial recessions. The largest investors are traditionally the Netherlands, Austria and Germany, which also included other countries in the analyzed period, South Korea, the Czech Republic and Luxembourg. The distribution of FDI from the regional point of view points to the tendency to enter the most developed regions in the west of Slovakia (especially in the Bratislava region) with built infrastructure and more favorable overall conditions compared to the regions in Central and Eastern Slovakia.

In conclusion, it is important to note that for the Slovak economy, an increase in the total FDI volume and its better sectoral and regional localization is important, with the aim of directing them to regions with high levels of unemployment, low industrialization and regions where unused production capacities are.

## References

- Caves, R. E. 2007. *Multinational Enterprise and Economic Analysis*. Cambridge University Press. 3rd edition. 2007. 402 p. Online ISBN 9780511619113 <https://doi.org/10.1017/CBO9780511619113>
- Devízový Zákon. The full text of the Act of the National Council of the Slovak Republic no. 202/1995 Coll. of September 20, 1995 Foreign Exchange Act and the Act amending the Act of the Slovak National Council no. 372/1990 Coll. on offenses in the wording of later regulations (by the wording) [cit. 2016-11-08]. Available on the Internet: [http://www.nbs.sk/\\_img/Documents/\\_Legislativa/\\_UplneZneniaZakonov/Z2\\_21995.pdf](http://www.nbs.sk/_img/Documents/_Legislativa/_UplneZneniaZakonov/Z2_21995.pdf)
- Dudáš, T. 2010. *Foreing Direct Investment on the Slovak Economy*. Bratislava: EKONÓM, 2010. ISBN 978-80-225-3084-2
- Dudová, I., Polónyová, S. 2017. Social Entrepreneurship: A Way Developing Social Innovation in Regions. (Web of Science). In: *Current Trends in Public Sector Research: Proceedings of the 21st International Conference*, Šľapanice. - Brno: Masarykova univerzita, 2017. - ISBN 978-80-210-8448-3. - p. 260-267.
- Dudová, I., Stanek, V. 2016. Migration - a challenge or another global threat In: *Proceedings of the IIInd International Scientific and Practical Conference "Methodology of Modern Research*, March 28-29, 2016 Dubai, UAE". - Dubai: ROSTranse Trade FZC company, 2016. - ISSN 2413-1032, p. 42-45
- Dunning, J. H. 2012. *International Production and the Multinational Enterprise (RLE International Business)*. Routledge, 456 p. ISBN 1138007846, 9781138007840
- Fabuš, M. 2014. Foreign direct investment and its impact on the Slovak Republic's economy, *Economic Annals-XXI*. 9-10(1). pp. 42-45
- Fabuš, M. 2015. Impact of foreign direct investment on unemployment development in selected regions of Slovak Republic, *Economic Annals XXI*. - ISSN 1728-6220 155(11-12): 63-66.
- Fabuš, M. 2017. Current Development of Business Environment in Slovakia and Czech Republic, *Entrepreneurship and Sustainability Issues* 5(1): 127-137. [https://doi.org/10.9770/jesi.2017.5.1\(10\)](https://doi.org/10.9770/jesi.2017.5.1(10))
- Fabuš, M. 2017. Development of quality of the business environment in Slovakia, In: *Modern science: 4th International multidisciplinary scientific conference on social sciences and arts SGEM 2017*. Conference proceedings Volume V. - Albena, Bulharsko: SGEM, 2017. - ISBN 978-619-7408-17-1. - ISSN 2367-5659, S. 305-310.
- Fabuš, M.; Csabay, M. 2018. State aid and investment: case of Slovakia, *Entrepreneurship and Sustainability Issues* 6(2): 480-488. [http://doi.org/10.9770/jesi.2018.6.2\(1\)](http://doi.org/10.9770/jesi.2018.6.2(1))
- Ferenčíková, S. et al. 2013. *International Business Expansion - Strategies, Partnerships, and Human Resources*. Bratislava: Wolters Kluwer, 364 p. ISBN 978-80-8078-532-1
- Kabát, L., Filip, S., Filipová, L. 2016. *Safety Measurmmment Peculiarities in Selected Countries*, *Journal of Security and Sustainability Issues* 6(3): 343-356. [http://dx.doi.org/10.9770/jssi.2017.6.3\(2\)](http://dx.doi.org/10.9770/jssi.2017.6.3(2))
- Gozora, V., Hudáková, M. 2014. Regional disparities of road transportation in Slovakia. In: *Informacijni tehnologii, ekonomika ta pravo: stan ta perspektivi rozvitku: Materiali mižnarodnoj naukovopraktičnoj konferenciji molodich včenich ta studentiv*, Černivci 3-4 kvitnya 2014: Vipusk 11. - Černivci: Bukovinskij universitet, pp. 139-147. ISBN 978-617-614-064-1.
- Hardy, J., Sass, M., Pollakova Fifekova, M. 2011. Impacts of horizontal and vertical foreign investment in business services: the experience of Hungary, Slovakia and the Czech Republic, *European Urban and Regional Studies* 18(4): 427-443. <https://doi.org/10.1177/0969776411422618>
- Kováč, M. 2016. How to measure security of citizens In: *Informacijni tehnologii, ekonomika ta pravo: stan ta perspektivi rozvitku: Materiali mižnarodnoj naukovopraktičnoj konferenciji molodich včenich ta studentiv*, Černivci 14-15 kvitnja 2016 : Vipusk 13. - Černivci: Bukovinskij universitet, 2016. - ISBN 978-617-614-028-3, p. 250-253.
- Krchová, H. 2018. New Approach to Innovation Projects. In: *Nordsci conference on social sciences: Conference proceedings*, Helsinki 17 - 19 July 2018. - Sofia: Saima Consult ISBN 978-619-7495-01-0, S. 183-190.
- Lincényi, M., Fabuš, M. 2017. Economic trends of business actors on daily newspaper market: case of the Slovak Republic, *Entrepreneurship and Sustainability Issues* 5(1): 91-104 [http://dx.doi.org/10.9770/jesi.2017.5.1\(7\)](http://dx.doi.org/10.9770/jesi.2017.5.1(7))

NBS. 2015. Methodical guidelines for compilation of annual reports on the state of foreign direct investment in the Czech Republic FDI (NBS) 1-01 and on the state of direct foreign investment FDI (NBS) 2-01 reported as at 31.12.2014. Available on the Internet: [http://www.nbs.sk/img/Documents/OHP/Metodika\\_2014.pdf](http://www.nbs.sk/img/Documents/OHP/Metodika_2014.pdf)

Siller, H., Cibák, E. 2016. Korruption und ihre gesamtwirtschaftliche Bedeutung, *Kriminalistik*, ISSN 0023-4699, 70(1): 50-55.

Stachová, K., Stacho, Z. 2017. Level of Focus of Organizations Operating in Slovakia on Flexible Organizational Structure, *International Review of Management and Marketing*. - Mersin: Cag University, ISSN 2146-4405. 7(1): 245-250.

Stachová, K., Stacho, Z. 2016. The Orientation on Innovation is a Challenge for Organisations operating in Slovakia (Web of Science). In: *Efficiency and Responsibility in Education 2016*: Proceedings of the 13th International Conference, Prague 2 - 3 June 2016. - Prague: Czech University of Life Sciences Prague, ISBN 978-80-213-2646-0. - p. 518-525.

Shuyan, L., Fabuš, M. 2019. Study on the spatial distribution of China's outward Foreign Direct Investment in EU and its influencing factors, *Entrepreneurship and Sustainability Issues* 6(3):1080-1096. [http://doi.org/10.9770/jesi.2019.6.3\(16\)](http://doi.org/10.9770/jesi.2019.6.3(16))

Táncošová, J., Slaný, A. 2004. Teoretické aspekty priamych zahraničných investícií. (Theoretical Aspects of Foreign Direct Investments) *Ekonomický časopis*. Bratislava: SAP, 1: 62-73. ISSN 0013-3035. UT WoS 000220045400004. Available on the Internet: [https://www.sav.sk/journals/ekoncas/ekon2004\\_01.htm#04](https://www.sav.sk/journals/ekoncas/ekon2004_01.htm#04)

Táncošová, J. 2013. Foreign direct investment and their influence on the economic development of Slovakia, *Economic Annals-XXI*. Naukovij žurnal Ukrainy No 3-4(1): 31-34. ISSN 1728-6220 (print), ISSN 1728-6239 (online). Available on the Internet: <http://soskin.info/ea/2013/3-4/zmist.html>

Táncošová, J., Švecová, S. 2012. Investment Attractiveness in the SR and the Effect on Foreign Investors. In: *Elektronický zborník vedeckých statí a posterov*. Gyongyos: Karoly Robert Foiskola. pp. 1484-1488. ISBN 978-963-9941-53

Tvaronavičienė, M., Masood, O., Javaria, K. 2018. Preconditions of the Eurozone economic security: how to overcome liquidity risk and cost inefficiency in leading banks of UK and Germany, *Polish Journal of Management Studies*, 18(1): 418-427 <http://doi.org/10.17512/pjms.2018.18.1.31>

Statistics of the Balance of Payments <https://www.nbs.sk/en/statistics/balance-of-payments-statistics/foreign-direct-investment>

Statistical office of SR <https://www.nbs.sk/en/statistics>

Štatistický úrad SR <https://slovak.statistics.sk/wps/portal/ext/themes>

UNCTAD. 2016. United Nations Conference on Trade and Development. World Investment Report 2016. Investor Nationality: Policy Challenges. Available on the Internet: [http://unctad.org/en/PublicationsLibrary/wir2016\\_en.pdf](http://unctad.org/en/PublicationsLibrary/wir2016_en.pdf)

Zeibote, Z.; Volkova, T.; Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development* 1(1): 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))

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## GRAPHIC MODEL FOR EVALUATING THE COMPETITIVENESS AND ECO-EFFICIENCY OF ECO-INNOVATIVE PROJECTS

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**Abstract.** Eco-innovation describes the creation of novel and competitively priced goods, processes, systems, services, policies, and procedures that satisfy human needs and improve the quality of life while ensuring sustainable development with minimal use of natural resources and minimal release of toxic substances. This article delves into one of the most pressing problems in improving the assessment of eco-innovative projects meant to effect sustainable development. The article also proposes new criteria for evaluating eco-innovation projects. The purpose is to develop and propose a graphic model by which to assess the innovativeness, competitiveness, and eco-efficiency of eco-innovation projects. In the development of this method, experts applied a methodological approach based on an assessment of the indicators of the innovativeness, competitiveness, and eco-efficiency of an eco-innovation project through the associated construction of a graphic model with indicators divided into nine sectors.

**Keywords:** graphic model; innovativeness; competitiveness; eco-efficiency; eco-innovative project; technological forecasting; comprehensive assessment

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### 1. Introduction

In recent times, the intensity of digitalization and innovative activities has largely been reflected in the level of sustainable economic development. In the global competition context, this can be seen in those countries that provide favorable economic conditions and innovation-related benefits. The development of an innovative economy is an important prerequisite to increasing the competitiveness of a country.



It has been observed that developed countries located in the global north are consistently striving to develop technological leadership and increase the efficiency of their innovation systems. This is effectively considered to be the amount spent on the scientific research and development (popularly known as R&D) as the percentage of the gross domestic product (GDP) of a country. Here, the performance of several countries was observed, and according to WIPO (2018), Israel took first place, spending 4.3% of its GDP on R&D, followed by the Republic of Korea with 4.2%. Switzerland received a conditional “bronze” at 3.4%; Sweden and Japan took the fourth and fifth positions with indicators of 3.3% and 3.1%, respectively.

From the experience of these countries, it can be safely concluded that a national innovation system is certain to be effective and sustainable if the countries allocate enough resources, modernizing services, and manufacturing sectors and other sub-sectors of the economy and develop a positive perception of innovation among their populaces. Considering their indispensability, these innovative developments are increasingly becoming the object of close attention at not only the government level but also the regional and individual economic entity levels.

Currently, many enterprises use traditional project analysis methods based on the criterion of net present value (NPV) (Žižlavský, 2014) by discounting future cash flows with regard to the current point in time (Bente Villadsen, 2017). This traditional method is usually designed for repetitive activities that are already backed by experience, accumulated expertise, and historical data to justify estimates.

The problem government agencies, investors, and analysts attempting to assess the potential of an eco-innovative project face lies in the specifics of such projects, which are unique and usually uncertain in terms of future results. In addition, these eco-innovative projects also have a long horizon of investment. These features can cause traditional methods of evaluating projects’ effectiveness to produce unreliable results largely because eco-innovative projects do not fulfill the basic prerequisites of these traditional methods. Thus, government agencies, investors, and shareholders in innovation have a keen interest in having more modern, reliable, and appropriate tools for evaluating eco-innovative projects in developed, emerging, and developing countries.

Eco-innovation refers to the creation of novel and competitively priced goods, processes, systems, services, and procedures that can satisfy human needs and improve the quality of life with a life-cycle-wide minimal use of natural resources (material including energy carriers and surface area) per unit output and a minimal release of toxic substances (quoted in Reid and Miedzinski, 2008). According to most definitions, eco-innovation reduces the environmental effects of consumption and production activities, regardless of whether doing so is the main motivation. Taking many forms, eco-innovation varies from incremental eco-efficiency improvements to fundamental change that replaces a system (Carrillo-Hermosilla et al., 2010; Tvaronavičienė, 2018; Eddelani et al., 2019; Bohdaniuk et al., 2019; Adamczyk et al., 2019; Atari et al. 2019).

With regard to the latter, the European Commission has promoted an integrated product policy aiming to support the realization of environmental product innovations that broadly reduce all environmental effects throughout a product’s life cycle. This has been conceptualized as “integrated environmental product innovation” (Triebswetter and Wackerbauer, 2008). Innovation has several roles in resource efficiency.

The disconnect between the real conditions of eco-innovative project development and the methods of analysis reveals the importance of developing a graphic model for assessing the innovativeness, competitiveness, and eco-effectiveness of eco-innovative projects to allow for a comprehensive assessment of a project’s absolute positioning.

To date, the issues relating to evaluating the effectiveness of eco-innovative projects seem to be sufficiently developed. Evidence suggests that specialists have been devoting extensive work to this issue. For example, Jeng and Huang (2015) proposed a hybrid multiple-criteria decision-making (MCDM) method comprising the master data management (MDM) method, the decision-making trial and evaluation laboratory (DEMATEL) method, and the analytic network process (ANP) approach. Multiple-criteria sorting methods based on data coverage analysis (DEA) have been developed to evaluate research and development (R&D) projects, as reviewed by Karasakal and Aker (2017). Dutra, Ribeiro, and de Carvalho (2014) considered issues relating to the use of the economic-probabilistic model for selecting projects and determining priorities. Their model enables the quantification of the necessary investments, potential benefits, and their inherent variability, thus providing a stochastic analysis of expected returns for projects. Similarly, Padhy and Sahu (2011) proposed a two-stage methodology based on analyzing realistic options for assessing the value of a project to increase management flexibility and a linear programming model with zero integer one to select and plan an optimal project portfolio based on the organization's goals and constraints. In some research publications (e.g., Huang et al., 2016), new models of mean variance and mean variability that consider the relationships and the temporal sequence between projects have been proposed. Likewise, Abdrakhmanova et al. (2018) noted the need to organize a phase-control system of knowledge intensity according to set quantitative and qualitative criteria in order to achieve knowledge-based results (products, technology, etc.) in innovation project implementation. Zhao, Yang, Zhao, and Zhao (2017) reviewed the influences of ecological programs in land cover change by evaluating a transition matrix and a modified land cover change dynamic model at the village level. According to Leach et al. (2018), long-term environmental research projects are a key factor in the functioning and dynamics of populations, communities, and ecosystems. Cluzel, Yannou, Millet, and Leroy (2016) adapted an eco-innovation process based on the eco-design strategy wheel, which is proposed for use with a working group of internal technical experts.

Nevertheless, the continuous expansion of the role knowledge plays in ensuring the effective functioning of innovative economic systems and the low rates of commercialization of R&D results in scientific, technical and manufacturing spheres requires a logical continuation of research in this direction. Therefore, it is necessary to clarify the specifics of innovative projects and develop a methodology for evaluating such projects and a means of information support for the evaluation process.

Against this backdrop, the purpose of this article is to develop a graphic model to assess the innovativeness, competitiveness, and eco-efficiency of eco-innovation projects. In the development of this method, a methodological approach was applied based on an assessment of the indicators of innovativeness, competitiveness, and eco-efficiency of eco-innovation projects.

Next, we provide the theoretical framework, followed by the results and conclusion.

## 2. Theoretical framework

Currently, the assessment of the environmental performance of a project is considered the most difficult aspect (Mutanov et al., 2018; Shvetsova et al., 2018). A project's compliance with environmental requirements as well as its innovativeness and competitiveness can only be determined if the method of its assessment considers several factors, including the following:

- Classification of the project according to the degree of environmental impact
- Coordination of the Terms of Reference (TOR) for assessment by appropriate criteria
- The implementation of basic requirements
- Control of accounting recommendations in the decisions made during the project
- Examination

- The environmental conditions of the project
- The implementation of environmental conditions at the project implementation stage

The evaluation process accompanies each stage of the project cycle. The assessment results at every stage are presented to the investor, followed by a joint discussion of the environmental problems and the development of common approaches to solve the problems. The results of the assessment should be enough to determine the launch of the project.

Scarpellini, Valero-Gil, and Portillo-Tarragona (2016) noted that eco-innovation provides motivation for the move towards sustainable development. However, in many European Union member countries, eco-innovation projects are not particularly common due to significant barriers and a general lack of culture of incorporating eco-innovation into organizational strategy in both government and corporate entities. Against the backdrop of this scenario, an analysis of the determinants of eco-innovation projects offers a new strategic approach to sustainable innovation initiative management. Important areas of evaluation are the innovativeness, competitiveness, and environmental attractiveness of the project. The most important criteria, which affect the associated project decisions, are elimination, prevention, reduction of environmental impact, and recycling of production and consumption byproducts (Table 1).

**Table 1.** Criteria for indicators of innovation and competitiveness of the innovation project

<b>Criteria for evaluating innovativeness</b>		
APPLICABILITY	1.1	Assessment of the importance of the project to the global economy
	1.2	Assessment of the importance of the project to the national economy
	1.3	Conformity assessment of projects to commercialize the results of scientific and technical activities with the trends and priorities relating to scientific and technical progress
SCIENTIFIC AND TECHNICAL POTENTIAL	2.1	Degree of scientific and technical novelty of the project
	2.2	Comparative assessment of the product (service) with existing counterparts in the market
	2.3	Technological (technical) feasibility of activities intended to achieve the project goal
MARKETING RESEARCH	3.1	Demand of business offered for commercialization of the results of scientific and technical activities
	3.2	Availability of potential consumers interested in the product / service
	3.3	Quality of development of the target market for product / service sales, as identified by geographic, sectoral and other characteristics
	3.4	Availability of confirmed data regarding the market volume (within bot the Kazakhstan and the global market)
	3.5	Competitive advantages of products or services in comparison with existing analogues
FINANCIAL PLAN FOR THE PROJECT	4.1	The reasonableness of the requested project funding
	4.2	Cost estimates for project implementation
<b>Criteria for evaluating competitiveness</b>		
READINESS FOR COMMERCIALIZATION	1.1	Assessment of opportunities to achieve the goal of the commercialization of the results of scientific and technical activities through planned activities
	1.2	Adequacy of the team's competence to implement the project
	1.3	Evaluation of the material and technical base on which the project is planned to be implemented
EVALUATION OF TECHNICAL AND PRODUCTION RISKS	2.1	Technical risks associated with the implementation of technical / technological solutions, including technical implementation being impossible
	2.2	Production risks associated with the organization of production, including a lack of the necessary raw material base and the identification of environmental problems
ECONOMIC INDICATORS OF THE PROJECT	3.1	Evaluation of the project's business model
	3.2	The validity of the economic indicators presented, including reasonable cost and sales prices of the proposed product / service
	3.3	The reasonableness of attracting the estimated number of team members
	3.4	Availability of raw materials, materials, etc.

AVAILABILITY OF CO-FINANCING	4.1	Availability of co-financing (for every 3% co-financing, 1 point is awarded with a maximum score of 9)
<b>Criterion for assessing eco-efficiency</b>		
SCALE OF ENVIRONMENTAL IMPACT	1.1	National: covers the economic regions or territory of several regions
	1.2	Regional: large city, region
	1.3	Local: district, village, rural district
	1.4	Local: industrial zone of the enterprise
IMPACT OBJECT	2.1	Public safety: long-term pollution of the environment, causing statistically recorded indicators of deterioration in the health of the population, threat to livelihoods
	2.2	Public health: environmental pollution which may lead to a deterioration in the health of the population
	2.3	Individual natural components: water bodies, atmospheric air, soils, forests, etc.
	2.4	Natural resources: minerals, underground and surface waters, flora and fauna
ENVIRONMENTAL SITUATION IN THE PROJECT AREA	3.1	Extremely unfavourable: according to long-term observations, the state of the environment is assessed by environmental authorities as extreme
	3.2	Unfavourable: indicators of the state of the environment or its individual components frequently exceed the maximum permissible values
	3.3	Generally favourable, but there are separate sources of pollution
TYPE OF PREVENTABLE ENVIRONMENTAL IMPACT	4.1	Surface water pollution
	4.2	Groundwater pollution
	4.3	Air pollution
	4.4	Pollution by hazardous industrial waste
	4.5	Soil pollution
	4.6	Noise, vibration, odours

### Graphic model for evaluating the innovativeness and competitiveness of innovative projects

From the perspective of the market, innovative projects involve three interacting segments: science, business, and nature:

$$K = f(I, L) \quad (1)$$

where  $I$  is the indicator of innovativeness,  $K$  is the indicator of competitiveness, and  $L$  is the indicator of eco-efficiency.

As shown in Figure 1, the evaluation of an innovation project through a graphic model to assess the innovativeness and competitiveness of a project occurs in three stages:



**Fig. 1.** The stages of evaluating innovativeness, competitiveness and eco-efficiency of an eco-innovative project

*Source:* modified by authors from Mutanov, 2015

These values are determined by calculating the average values of expert estimates of each criterion. Possible criteria are presented in Table 1.

These values are determined by calculating the average values of expert estimates of each indicator, which, according to Mutanov (2015), are determined by the following formulas:

$$I_j = \sum_{i=1}^n x_i f_{ij}, \sum_{i=1}^n x_i = 1, \quad (2)$$

$$K_j = \sum_{k=1}^m y_k g_{kj}, \sum_{k=1}^m y_k = 1, \quad (3)$$

$$L_j = \sum_{l=1}^p z_l h_{lj}, \sum_{l=1}^p z_l = 1, \quad (4)$$

$$I_{min} \leq I_j \leq I_{max}, K_{min} \leq K_j \leq K_{max}, L_{min} \leq L_j \leq L_{max} \quad (5)$$

where  $f_{ij}$  is the value of the  $i$ -th criterion of the  $j$ -th object (project) for the innovativeness indicator;

$x_i$  is the weighting coefficient of the  $i$ -th criterion for the innovativeness indicator;

$n$  is the number of criteria for the innovativeness indicator;

$g_{kj}$  is the value of the  $k$ -th criterion of the  $j$ -th object (project) for the competitiveness indicator;

$y_k$  is the weighting coefficient of the  $k$ -th factor for the competitiveness indicator;

$m$  is the number of criteria for the competitiveness indicator;

$h_{lj}$  is the value of the  $l$ -th criterion of the  $j$ -th object (project) for the eco-efficiency indicator;

$z_l$  is the weighting coefficient of the  $l$ -th factor for the eco-efficiency indicator;

$p$  is the number of criteria for the eco-efficiency indicator;

$j = \overline{1, J}$  with  $J$  being the number of objects (projects); and

$I_{min}, I_{max}, K_{min}, K_{max}, L_{min}, L_{max}$  are the minimum and maximum values of the innovativeness, competitiveness, and eco-efficiency indicators, respectively (Mutanov, 2015).

Thus, it is necessary to determine the value of indicators  $I$  and  $K$ , provided that each criterion is assigned an expert weighting factor and a value between 1 and 9 (Table 2).

**Table 2.** System of expert assessments of the innovative project

Threshold	Score	Evaluation Ratings	Description of assessments, indicating strengths and weaknesses
High	9	Exclusively	With exceptionally strong points without weaknesses
	8	Outstanding	With strengths and with insignificant weaknesses
	7	Fine	With strengths and with some minor weaknesses
Average	6	Very good	With strengths and with numerous minor weaknesses
	5	Good	With some strengths and moderate weaknesses
	4	Satisfactorily	With some strengths, but with one significant weakness
Low	3	Weakly	With minor strengths and multiple weaknesses.
	2	Unsatisfactory	Without strengths and significant weaknesses
	1	Extreme	Weaknesses without strengths

In order to adequately assess the significance of each criterion when determining the overall indicator, it is more rational to use weights and to apply a ranking method of calculation.

According to Mutanov (2015),

$$R_j = \sum_{k=1}^M R_{jk}, \quad (6)$$

where  $R_j$  is the sum of the ranks converted across all the experts for the  $j$ -th factor,  $R_{jk}$  is the converted rank assigned by the  $k$ -th expert to the  $j$ -th factor, and  $M$  is the number of experts.

Next, the weights of the various criteria are calculated, according to Mutanov (2015):

$$W_j = R_j / \sum_{j=1}^N R_j, \quad (7)$$

where  $W_j$  is the average weight of the criterion across all the experts;  $N$  is the number of criteria.

An important component of the graphic model in assessing the innovativeness and competitiveness of a project is the judgment matrix, in which the values of the elements are not based on accurate measurements but rather on subjective judgments (these matrices are prepared by experts). The matrix of judgments is:

$$A = (a_{ij}), i, j = 1, 2, \dots, J, \quad (8)$$

where  $a_{ij}$  is the number corresponding to the significance of the object (criteria  $I$  and  $K$ ).

The “quality” of the expert filling in the judgment matrix is determined through the consistency relationship ( $OS$ ). Values of  $OS \leq 0.1$  are considered acceptable. For judgment matrix  $A$ , one must find the maximum eigenvalue  $\lambda_{max}$  and the vector of eigenvalues  $Z$ , i.e., it is necessary to solve the following equation:

$$A \times Z = Z - \lambda_{max}. \quad (9)$$

The components of the vector  $Z$  are weight coefficients.



The consistency of the expert estimates according to the criteria was verified by calculating the coefficients of the variation of the factors, which are analogues of the variance:

$$S_i = \frac{m}{m-1} \times \frac{(\sum_{j=1}^n f_{ij})^2 - \sum_{j=1}^n f_{ij}^2}{(\sum_{j=1}^n f_{ij})^2}, \quad (10)$$

where  $S_i$  is the factor variation coefficient;  $f_{ij}$  is the average value of the total number of  $f_{ij}$  ranks of the  $i$ -th factor, as assigned by the  $j$ -th expert;  $m$  is the number of experts; and  $n$  is the number of criteria.

Since in our case experts are represented by various structures, it is necessary to control their homogeneity. To solve this problem, according to the estimates of various criteria received from experts, a concordance is defined: the consistency of their opinions. The coefficient of concordance  $W$  was calculated using the formula Kendall proposed:

$$W = \frac{12 \times S}{m^2 \times (n^3 - n)}, \quad (11)$$

where  $S$  is the sum of squared differences (deviations),  $m$  is the number of experts, and  $n$  is the number of criteria.

The significance of the  $W$  coefficients was verified for a confidence level of 0.01 (99%) using the  $\chi^2$  criterion, which minimizes the second kind of error (accepting the wrong hypothesis), at the  $\alpha$  significance level—the probability of rejecting a valid hypothesis (the first kind of error), and the number of degrees of freedom  $f$ .

The value of the  $\chi^2$  statistics can be calculated via the formula:

$$\chi^2 = m \times f \times W \quad (12)$$

where  $m$  is the number of experts,  $f$  is the number of degrees of freedom  $f = k - 1$ , and  $W$  is the coefficient of concordance.

The next stage of selection is the positioning of innovative projects based on the resulting graphic model.

### 3. Research methodology

As this is a preliminary study, the aim of the literature analysis was to identify the main factors affecting environmental change and eco-innovation in the environmental sector for 110 years (1901–2011). In this paper, (computer) content analysis was used as an analytical method for a longitudinal and systematic study of secondary sources of information (Stone et al., 1966; Woodrum, 1984; Bringer et al., 2006). More information about the method used in this article can be found in Montalvo, Diaz-Lopez, and Brandez (2011).

This study uses a thematic approach to better understand the role of ISC in environmental building design projects. Ketokivi and Choi (2014) discuss three different methodological approaches to the study of specific cases: the creation of a theory, the verification of the theory, and theory development. Theory development is not aimed at creating new theories or testing existing theories. This approach can be used to introduce new concepts, study boundary conditions, or study relationships between concepts. Unlike theoretical testing studies, this study

did not expect empirical results from a priori formulations of judgments (see Ketokivi and Choi, 2014). Therefore, the design of the study is in better agreement with the inductive than with the deductive approach. This study aims to develop a theory by analyzing empirical data collected using a multiple case study approach (Yin et al., 2014). Although multiple cases are used, the goal is not to compare individual cases. These cases are used to explore and describe the role of ISC in projects. The study was conducted on the basis of expert assessments and investigated two projects implemented in Kazakhstan by time experts. The experts assessed a total of 40 indicators, each of which received a score ranging from 1 to 9 points, in three criteria categories.

#### 4. Results

As an example, two projects that experts evaluated according to the criteria of innovation, competitiveness, and eco-efficiency were examined. The averages of each expert estimate of the indicators of innovation, competitiveness, and eco-efficiency are presented in Tables 3, 4, and 5.

**Table 3.** Average estimates of the criteria for evaluating innovativeness

Criteria for evaluating innovativeness			Project №1	Project №2	Project №1	Project №2	Project №1	Project №2
			1 <sup>st</sup> expert		2 <sup>nd</sup> expert		3 <sup>rd</sup> expert	
APPLICABILITY	1.1	Assessment of the importance of the project to the global economy	3	5	2	6	3	8
	1.2	Assessment of the importance of the project to the national economy	5	9	4	9	4	9
	1.3	Conformity assessment of projects commercializing the results of scientific and technical activities with the trends and priorities of scientific and technical progress	4	8	3	8	2	9
SCIENTIFIC AND TECHNICAL POTENTIAL	2.1	Degree of scientific and technical novelty of the project	4	8	3	7	4	8
	2.2	Comparative assessment of the product (service) with existing counterparts in the market	3	7	4	8	4	7
	2.3	Technological (technical) feasibility of activities to achieve the project goal	7	9	6	8	6	9
MARKETING RESEARCH	3.1	Demand of business offered for commercialization of the results of scientific and technical activities	4	7	3	8	4	7
	3.2	Availability of potential consumers interested in the product / service	5	9	6	8	6	9
	3.3	Quality of the development of the target market for product / service sales, as identified by geographic, sectoral and other characteristics	5	6	6	5	7	8
	3.4	Availability of confirmed data about the market volume	5	6	7	6	6	6

		(within both Kazakhstan and the global market)						
	3.5	Competitive advantages of products or services in comparison with existing analogues	4	7	3	7	4	8
FINANCIAL PLAN FOR THE PROJECT	4.1	The reasonableness of the project funding requested	5	8	6	9	6	9
	4.2	Cost estimates for project implementation	4	7	7	9	6	9

**Table 4.** Average estimates of the criteria for evaluating competitiveness

	Criteria for evaluating competitiveness		Project №1	Project №2	Project №1	Project №2	Project №1	Project №2
			1 <sup>st</sup> expert		2 <sup>nd</sup> expert		3 <sup>rd</sup> expert	
READINESS FOR COMMERCIALIZATION	1.1	Assessment of opportunities to achieve the goal of commercialization of the results of scientific and technical activities through planned activities	3	8	4	8	3	7
	1.2	Sufficiency of the team's competence to implement the project	7	8	6	8	6	8
	1.3	Evaluation of the material and technical base on which the project will be implemented	7	8	7	8	6	8
EVALUATION OF TECHNICAL AND PRODUCTION RISKS	2.1	Technical risks associated with the implementation of technical / technological solutions, including technical implementation being impossible	8	4	8	3	8	3
	2.2	Production risks associated with the organization of production, including a lack of the necessary raw material base, and the identification of environmental problems	5	3	4	2	4	2
ECONOMIC INDICATORS OF THE PROJECT	3.1	Evaluation of the project business model	6	8	7	8	7	8
	3.2	The validity of the economic indicators presented, including the reasonableness of the cost and sales price of the proposed product / service	6	8	7	8	7	8
	3.3	The reasonableness of attracting the estimated number of team members	7	8	8	8	8	9
	3.4	Availability of raw materials, materials, etc.	7	8	8	8	8	8
AVAILABILITY OF CO-FINANCING	4.1	Availability of co-financing (for every 3% co-financing, 1 point is awarded with a maximum score of 9)						
			2	4	2	4	2	4

**Table 5.** Average estimates of the criteria for evaluating eco-efficiency

	Criterion for assessing eco-efficiency		Project №1	Project №2	Project №1	Project №2	Project №1	Project №2
			1 <sup>st</sup> expert		2 <sup>nd</sup> expert		3 <sup>rd</sup> expert	
SCALE OF ENVIRONMENTAL IMPACT	1.1	National: covers the economic regions or territory of several regions	5	9	4	9	4	9
	1.2	Regional: large city, region	3	7	2	7	2	7
	1.3	Local: district, village, rural district	3	5	3	5	2	6
	1.4	Local: industrial zone of the enterprise	1	2	1	1	1	3
IMPACT OBJECT	2.1	Public safety: long-term pollution of the environment, causing statistically recorded indicators of deterioration in the health of the population, threat to livelihoods	7	9	7	8	8	9
	2.2	Public health: environmental pollution, which may lead to a deterioration in the health of the population	5	6	6	7	6	8
	2.3	Individual natural components: water bodies, atmospheric air, soils, forests, etc.	4	5	5	6	5	7
	2.4	Natural resources: minerals, underground and surface waters, flora and fauna	2	3	2	4	2	5
ENVIRONMENTAL SITUATION IN THE PROJECT AREA	3.1	Extremely unfavourable: according to long-term observations, the state of the environment is assessed by environmental authorities as extreme	7	9	6	8	7	8
	3.2	Unfavourable: indicators of the state of the environment or its individual components frequently exceed the maximum permissible values	4	5	5	6	5	6
	3.3	Generally favourable, but there are separate sources of pollution	1	2	2	2	1	2
TYPE OF PREVENTABLE ENVIRONMENTAL IMPACT	4.1	Surface water pollution	5	6	4	7	5	7
	4.2	Groundwater pollution	5	6	4	7	5	6
	4.3	Air pollution	7	9	7	9	8	9
	4.4	Pollution by hazardous industrial waste	5	6	4	7	4	6
	4.5	Soil pollution	2	3	2	4	2	3
	4.6	Noise, vibration, odours	1	1	1	2	2	2

The experts assessed the significance of the parameters by assigning them a rank number. The factor to which the expert gave the highest score was assigned rank 1. If the expert recognized several factors as equivalent, they were assigned the same rank number. Based on the data obtained from the questionnaire survey, a summary matrix of ranks was compiled. Since there are related ranks in the matrix (the same rank number) in the assessments of the first expert and since there are also related ranks in the assessments of the second and third experts, we will reform them. The reformation of ranks must be carried out without changing the experts' opinions; that is, the corresponding ratios between the ranking numbers must be preserved (more, less, or equal). Putting a rank above 1 or below the number of parameters is also not recommended.

**Table 6.** Rank matrix of the criteria for evaluating innovativeness

Indicators / Experts	1	2	3	Sum of ranks	$S_i$	$S_i^2$	Indicators / Experts	1	2	3	Sum of ranks	$S_i$	$S_i^2$
Project №1							Project №2						
x <sub>1</sub>	1.5	1	2	4.5	-16.5	272.25	x <sub>1</sub>	1	2.5	5.5	9	-12	144
x <sub>2</sub>	10	6.5	5	21.5	0.5	0.25	x <sub>2</sub>	12	12	10.5	34.5	13.5	182.25
x <sub>3</sub>	5	3.5	1	9.5	-11.5	132.25	x <sub>3</sub>	9	8	10.5	27.5	6.5	42.25
x <sub>4</sub>	5	3.5	5	13.5	-7.5	56.25	x <sub>4</sub>	9	4.5	5.5	19	-2	4
x <sub>5</sub>	1.5	6.5	5	13	-8	64	x <sub>5</sub>	5.5	8	2.5	16	-5	25
x <sub>6</sub>	13	9.5	10	32.5	11.5	132.25	x <sub>6</sub>	12	8	10.5	30.5	9.5	90.25
x <sub>7</sub>	5	3.5	5	13.5	-7.5	56.25	x <sub>7</sub>	5.5	8	2.5	16	-5	25
x <sub>8</sub>	10	9.5	10	29.5	8.5	72.25	x <sub>8</sub>	12	8	10.5	30.5	9.5	90.25
x <sub>9</sub>	10	9.5	13	32.5	11.5	132.25	x <sub>9</sub>	2.5	1	5.5	9	-12	144
x <sub>10</sub>	10	12.5	10	32.5	11.5	132.25	x <sub>10</sub>	2.5	2.5	1	6	-15	225
x <sub>11</sub>	5	3.5	5	13.5	-7.5	56.25	x <sub>11</sub>	5.5	4.5	5.5	15.5	-5.5	30.25
x <sub>12</sub>	10	9.5	10	29.5	8.5	72.25	x <sub>12</sub>	9	12	10.5	31.5	10.5	110.25
x <sub>13</sub>	5	12.5	10	27.5	6.5	42.25	x <sub>13</sub>	5.5	12	10.5	28	7	49
$\Sigma$	<b>91</b>	<b>91</b>	<b>91</b>	<b>273</b>		<b>1221</b>	$\Sigma$	<b>91</b>	<b>91</b>	<b>91</b>	<b>273</b>		<b>1161.5</b>

**Table 7.** Rank matrix of the criteria for evaluating competitiveness

Indicators / Experts	1	2	3	Sum of ranks	$S_k$	$S_k^2$	Indicators / Experts	1	2	3	Sum of ranks	$S_k$	$S_k^2$
Project №1							Project №2						
y <sub>1</sub>	2	2.5	2	6.5	-10	100	y <sub>1</sub>	7	7	4	18	1.5	2.25
y <sub>2</sub>	7.5	4	4.5	16	-0.5	0.25	y <sub>2</sub>	7	7	7	21	4.5	20.25
y <sub>3</sub>	7.5	6	4.5	18	1.5	2.25	y <sub>3</sub>	7	7	7	21	4.5	20.25
y <sub>4</sub>	10	9	9	28	11.5	132.25	y <sub>4</sub>	2.5	2	2	6.5	-10	100
y <sub>5</sub>	3	2.5	3	8.5	-8	64	y <sub>5</sub>	1	1	1	3	-13.5	182.25
y <sub>6</sub>	4.5	6	6.5	17	0.5	0.25	y <sub>6</sub>	7	7	7	21	4.5	20.25
y <sub>7</sub>	4.5	6	6.5	17	0.5	0.25	y <sub>7</sub>	7	7	7	21	4.5	20.25
y <sub>8</sub>	7.5	9	9	25.5	9	81	y <sub>8</sub>	7	7	10	24	7.5	56.25
y <sub>9</sub>	7.5	9	9	25.5	9	81	y <sub>9</sub>	7	7	7	21	4.5	20.25
y <sub>10</sub>	1	1	1	3	-13.5	182.25	y <sub>10</sub>	2.5	3	3	8.5	-8	64
$\Sigma$	<b>55</b>	<b>55</b>	<b>55</b>	<b>165</b>		<b>643.5</b>	$\Sigma$	<b>55</b>	<b>55</b>	<b>55</b>	<b>165</b>		<b>506</b>

**Table 8.** Rank matrix of the criteria for evaluating eco-efficiency

Indicators / Experts	1	2	3	Sum of ranks	$S_l$	$S_l^2$	Indicators / Experts	1	2	3	Sum of ranks	$S_l$	$S_l^2$
Project №1							Project №2						
z <sub>1</sub>	12	9.5	8.5	30	3	9	z <sub>1</sub>	15.5	16.5	16	48	21	441
z <sub>2</sub>	6.5	4.5	5	16	-11	121	z <sub>2</sub>	13	11	11	35	8	64
z <sub>3</sub>	6.5	7	5	18.5	-8.5	72.25	z <sub>3</sub>	7	6	7.5	20.5	-6.5	42.25
z <sub>4</sub>	2	1.5	1.5	5	-22	484	z <sub>4</sub>	2.5	1	3.5	7	-20	400
z <sub>5</sub>	16	16.5	16.5	49	22	484	z <sub>5</sub>	15.5	14.5	16	46	19	361
z <sub>6</sub>	12	14.5	14	40.5	13.5	182.25	z <sub>6</sub>	10.5	11	13.5	35	8	64
z <sub>7</sub>	8.5	12.5	11.5	32.5	5.5	30.25	z <sub>7</sub>	7	7.5	11	25.5	-1.5	2.25
z <sub>8</sub>	4.5	4.5	5	14	-13	169	z <sub>8</sub>	4.5	4.5	5	14	-13	169
z <sub>9</sub>	16	14.5	15	45.5	18.5	342.25	z <sub>9</sub>	15.5	14.5	13.5	43.5	16.5	272.25
z <sub>10</sub>	8.5	12.5	11.5	32.5	5.5	30.25	z <sub>10</sub>	7	7.5	7.5	22	-5	25
z <sub>11</sub>	2	4.5	1.5	8	-19	361	z <sub>11</sub>	2.5	2.5	1.5	6.5	-20.5	420.25
z <sub>12</sub>	12	9.5	11.5	33	6	36	z <sub>12</sub>	10.5	11	11	32.5	5.5	30.25
z <sub>13</sub>	12	9.5	11.5	33	6	36	z <sub>13</sub>	10.5	11	7.5	29	2	4
z <sub>14</sub>	16	16.5	16.5	49	22	484	z <sub>14</sub>	15.5	16.5	16	48	21	441
z <sub>15</sub>	12	9.5	8.5	30	3	9	z <sub>15</sub>	10.5	11	7.5	29	2	4
z <sub>16</sub>	4.5	4.5	5	14	-13	169	z <sub>16</sub>	4.5	4.5	3.5	12.5	-14.5	210.25
z <sub>17</sub>	2	1.5	5	8.5	-18.5	342.25	z <sub>17</sub>	1	2.5	1.5	5	-22	484
$\Sigma$	<b>153</b>	<b>153</b>	<b>153</b>	<b>459</b>		<b>3361.5</b>	$\Sigma$	<b>153</b>	<b>153</b>	<b>153</b>	<b>459</b>		<b>3434.5</b>



Therein,

$$S_i = \sum x_{ij} - \frac{\sum \sum x_{ij}}{n} = \sum x_{ij} - 21 \text{ (Project №1, №2)}$$

$$S_k = \sum y_{kj} - \frac{\sum \sum y_{kj}}{n} = \sum y_{kj} - 16.5 \text{ (Project №1, №2)}$$

$$S_l = \sum z_{lj} - \frac{\sum \sum z_{lj}}{n} = \sum z_{lj} - 27 \text{ (Project №1, №2)}$$

The correctness of the matrix on the basis of the checksum calculation is then verified:

$$\sum x_{ij} = \frac{(1+n)n}{2} = \frac{(1+13)13}{2} = 91 \text{ (Project №1, №2)}$$

$$\sum y_{kj} = \frac{(1+n)n}{2} = \frac{(1+10)10}{2} = 55 \text{ (Project №1, №2)}$$

$$\sum z_{lj} = \frac{(1+n)n}{2} = \frac{(1+17)17}{2} = 153 \text{ (Project №1, №2)}$$

The sums of the columns of the matrix are equal to both each other and the checksum, which means that the matrix is composed correctly.

The assessment of the average degree of consistency of the opinions of all the experts is determined by the coefficient of concordance in the instance of related ranks (the same values of ranks in the assessments of one expert):

$$W = \frac{S}{\frac{1}{12} \times m^2 (n^3 - n) - m \times \sum T_i}, \quad (13)$$

where  $S_i = 1221$ ,  $n = 13$ ,  $m = 3$  (Project №1);  $S_i = 1161.5$ ,  $n = 13$ ,  $m = 3$  (Project №2)

$S_k = 645.5$ ,  $n = 10$ ,  $m = 3$  (Project №1);  $S_k = 506$ ,  $n = 13$ ,  $m = 3$  (Project №2)

$S_l = 3361.5$ ,  $n = 17$ ,  $m = 3$  (Project №1);  $S_l = 3434.5$ ,  $n = 17$ ,  $m = 3$  (Project №2)

$$T_i = \frac{1}{12} \sum (t_w^3 - t_w), \quad (14)$$

where  $T_i$  is the number of bundles (types of repeating elements) in the estimates of the  $i$ -th expert and  $t_w$  is the number of elements in the  $l$ -th bundle for the  $i$ -th expert (the number of repeating elements).

$$T_1 = [(2^3-2) + (5^3-5) + (5^3-5)]/12 = 20.5$$

$$T_2 = [(2^3-2) + (4^3-4) + (4^3-4) + (2^3-2)]/12 = 11$$

$$T_3 = [(5^3-5) + (5^3-5)]/12 = 20$$

$$\sum T_i = 20.5 + 11 + 20 = 51.5 \text{ (Project №1)}$$

$$W = \frac{1221}{\frac{1}{12} \times 3^2 (13^3 - 13) - 3 \times 51.5} = 0.82 \text{ (Project №1)}$$

$$T_1 = [(3^3-3) + (3^3-3) + (4^3-4) + (2^3-2)]/12 = 9.5$$

$$T_2 = [(2^3-2) + (3^3-3) + (5^3-5) + (2^3-2)]/12 = 13$$

$$T_3 = [(4^3-4) + (6^3-6) + (2^3-2)]/12 = 23$$

$$\sum T_i = 9.5 + 13 + 23 = 45.5 \text{ (Project №2)}$$

$$W = \frac{1161,5}{\frac{1}{12} \times 3^2 (13^3 - 13) - 3 \times 45.5} = 0,77 \text{ (Project №2)}$$

$$T_1 = [(4^3-4) + (2^3-2)]/12 = 5.5$$

$$T_2 = [(2^3-2) + (3^3-3) + (3^3-3)]/12 = 4.5$$

$$T_3 = [(2^3-2) + (3^3-3) + (2^3-2)]/12 = 3$$

$$\sum T_k = 5.5 + 4.5 + 3 = 13 \text{ (Project №1)}$$

$$W = \frac{643,5}{\frac{1}{12} \times 3^2 (10^3 - 10) - 3 \times 13} = 0,91 \text{ (Project №1)}$$

$$T_1 = [(7^3-7) + (2^3-2)]/12 = 28.5$$

$$T_2 = [(7^3-7)]/12 = 28$$

$$T_3 = [(5^3-5)]/12 = 10$$

$$\sum T_k = 28.5 + 28 + 10 = 66.5 \text{ (Project №2)}$$

$$W = \frac{506}{\frac{1}{12} \times 3^2 (10^3 - 10) - 3 \times 66.5} = 0,93 \text{ (Project №2)}$$

$$T_1 = [(5^3-5) + (2^3-2) + (3^3-3) + (3^3-3) + (2^3-2) + (2^3-2)]/12 = 15.5$$

$$T_2 = [(4^3-4) + (4^3-4) + (2^3-2) + (2^3-2) + (2^3-2) + (2^3-2)]/12 = 12$$

$$T_3 = [(2^3-2) + (5^3-5) + (2^3-2) + (2^3-2) + (4^3-4)]/12 = 16.5$$

$$\sum T_i = 15.5 + 12 + 16.5 = 44 \text{ (Project №1)}$$

$$W = \frac{3361,5}{\frac{1}{12} \times 3^2 (17^3 - 17) - 3 \times 44} = 0,95 \text{ (Project №1)}$$

$$T_1 = [(4^3-4) + (3^3-3) + (2^3-2) + (4^3-4) + (2^3-2)]/12 = 13$$

$$T_2 = [(2^3-2) + (5^3-5) + (2^3-2) + (2^3-2) + (2^3-2) + (2^3-2)]/12 = 12.5$$

$$T_3 = [(3^3-3) + (3^3-3) + (4^3-4) + (2^3-2) + (2^3-2) + (2^3-2)]/12 = 10.5$$

$$\sum T_i = 13 + 12.5 + 10.5 = 36 \text{ (Project №2)}$$

$$W = \frac{3434,5}{\frac{1}{12} \times 3^2 (17^3 - 17) - 3 \times 36} = 0,96 \text{ (Project №2)}$$

W = 0.82; 0.77; 0.91; 0.93; 0.95; 0.96 indicates a high degree of consistency of expert opinions.

The significance of the coefficient of concordance is determined by calculating the Pearson matching criterion:

$$\chi^2 = \frac{S}{\frac{1}{12} \times mn(n+1) + \frac{1}{n-1} \times \sum T_i}$$

$$\chi_i^2 = \frac{1221}{\frac{1}{12} \times 3 \times 13(13+1) + \frac{1}{13-1} \times 51.5} = 29.63 \text{ (Project №1)}$$

$$\chi_i^2 = \frac{1161,5}{\frac{1}{12} \times 3 \times 13(13+1) + \frac{1}{13-1} \times 45.5} = 27.85 \text{ (Project №2)}$$

$$\chi_k^2 = \frac{643,5}{\frac{1}{12} \times 3 \times 10(10+1) + \frac{1}{10-1} \times 13} = 24.7 \text{ (Project №1)}$$

$$\chi_k^2 = \frac{506}{\frac{1}{12} \times 3 \times 10(10+1) + \frac{1}{10-1} \times 66.5} = 25.16 \text{ (Project №2)}$$

$$\chi_l^2 = \frac{3361,5}{\frac{1}{12} \times 3 \times 17(17+1) + \frac{1}{17-1} \times 44} = 45.58 \text{ (Project №1)}$$

$$\chi_l^2 = \frac{3434,5}{\frac{1}{12} \times 3 \times 17(17+1) + \frac{1}{17-1} \times 36} = 46.26 \text{ (Project №2)}$$

The  $\chi^2$  calculated is comparable to the table value for the number of degrees of freedom

$K = n - 1 = 13 - 1 = 12$ ;  $K = n - 1 = 10 - 1 = 9$ ;  $K = n - 1 = 17 - 1 = 16$  and at a given significance level  $\alpha = 0.01$ . Since  $\chi^2$  is a calculated  $29.63 \geq \text{tabular (26.21697)}$ ,  $27.85 \geq \text{tabular (26.21697)}$ ,  $24.7 \geq \text{tabular (21.66599)}$ ,  $25.16 \geq \text{tabular (21.66599)}$ ,  $45.58 \geq \text{tabular (31.99993)}$ ,  $46.26 \geq \text{tabular (31.99993)}$ , then  $W = 0.82, 0.77, 0.91, 0.93, 0.95, 0.96$  is not a random value, and therefore the results obtained make sense and can be used in further studies.

Based on the sum of the ranks (table), we can calculate the weights of the parameters considered. We transform the survey matrix into a matrix of transformed ranks using the formula  $s_{ij} = x_{\max} - x_{ij}$ ;  $s_{kj} = y_{\max} - y_{kj}$ ;  $s_{lj} = z_{\max} - z_{lj}$ , where  $x_{\max} = 7$  (Project 1);  $x_{\max} = 9$  (Project 2);  $y_{\max} = 8$  (Project 1);  $y_{\max} = 9$  (Project 2);  $z_{\max} = 8$  (Project 1);  $z_{\max} = 9$  (Project 2).

**Table 9.** Average estimates of the criteria of innovation

	Criteria for evaluating innovativeness		Weights of criteria Project №1	Value of the criteria (averaged estimates for the Project №1)	Weights of criteria Project №2	Value of the criteria (averaged estimates for the Project №2)	Normalized estimate of priority vector, Project №1	Normalized estimate of priority vector, Project №2
APPLICABILITY	1.1	Assessment of the importance of the project to the global economy	0.1398	4.5	0.1569	6	13	8
	1.2	Assessment of the importance of the project to the national economy	0.08602	9.5	0	9	8	0
	1.3	Conformity assessment of projects commercializing the results of scientific and technical activities with the trends and priorities of scientific and technical progress	0.129	13	0.03922	9	12	2
SCIENTIFIC AND TECHNICAL POTENTIAL	2.1	Degree of scientific and technical novelty of the project	0.1075	13.5	0.07843	15.5	10	4
	2.2	Comparative assessment of the product (service) with existing counterparts in the market	0.1075	13.5	0.09804	16	10	5
	2.3	Technological (technical) feasibility of activities to achieve the project goal	0.02151	13.5	0.01961	16	2	1
MARKETING RESEARCH	3.1	Demand of business offered for commercialization of the results of scientific and technical activities	0.1075	21.5	0.09804	19	10	5
	3.2	Availability of potential consumers interested in the product / service	0.04301	27.5	0.01961	27.5	4	1
	3.3	Quality of development of the target market for product / service sales, identified by geographic, sectoral and other characteristics	0.03226	29.5	0.1569	28	3	8
	3.4	Availability of confirmed data on the market volume (within both Kazakhstan and the global market)	0.03226	29.5	0.1765	30.5	3	9
	3.5	Competitive advantages of products or services in comparison with existing analogues	0.1075	32.5	0.09804	30.5	10	5
FINANCIAL PLAN FOR THE PROJECT	4.1	The reasonableness of the requested project funding	0.04301	32.5	0.01961	31.5	4	1
	4.2	Cost estimates for project implementation	0.04301	32.5	0.03922	34.5	4	2
			<b>1</b>		<b>1</b>		<b>93</b>	<b>51</b>

**Table 10.** Average estimates of the criteria of competitiveness

	Criteria for evaluating competitiveness		Weights of criteria	Value of the criteria (averaged estimates for the Project №1)	Weights of criteria	Value of the criteria (averaged estimates for the Project №2)	Normalized estimate of priority vector, Project №1	Normalized estimate of priority vector, Project №2
READINESS FOR COMMERCIALIZATION	1.1	Assessment of opportunities to achieve the goal of the project of commercialization of the results of scientific and technical activities through planned activities	0.2258	3	0.05479	3	14	4
	1.2	Sufficiency of the team's competence to implement the project	0.08065	6.5	0.0411	6.5	5	3
	1.3	Evaluation of the material and technical base on which the project will be implemented	0.06452	8.5	0.0411	8.5	4	3
EVALUATION OF TECHNICAL AND PRODUCTION RISKS	2.1	Technical risks associated with the implementation of technical / technological solutions, including technical implementation being impossible	0	16	0.2329	18	0	17
	2.2	Production risks associated with the organization of production, including a lack of the necessary raw materials base, and the identification of environmental problems	0.1774	17	0.274	21	11	20
ECONOMIC INDICATORS OF THE PROJECT	3.1	Evaluation of the project business model	0.06452	17	0.0411	21	4	3
	3.2	The validity of the economic indicators presented, including the reasonableness of the cost and sales price of the proposed product / service	0.06452	18	0.0411	21	4	3
	3.3	The reasonableness of attracting the estimated number of team members	0.01613	25.5	0.0274	21	1	2
	3.4	Availability of raw materials, materials, etc.	0.01613	25.5	0.0411	21	1	3
AVAILABILITY OF CO-FINANCING	4.1	Availability of co-financing (for every 3% co-financing, 1 point is awarded with a maximum score of 9)	0.2903	28	0.2055	24	18	15
			<b>1</b>		<b>1</b>		<b>62</b>	<b>73</b>

**Table 11.** Average estimates of the criteria of eco-efficiency

	Criterion for assessing eco-efficiency		Weight s of criteria	Value of the criteria (averaged estimates for the Project №1)	Weight s of criteria	Value of the criteria (averaged estimates for the Project №2)	Normalize d estimate of priority vector, Project №1	Normalize d estimate of priority vector, Project №2
SCALE OF ENVIRONMENTAL IMPACT	1.1	National: covers the economic regions or territory of several regions	0.05314	5	0	5	11	0
	1.2	Regional: large city, region	0.08213	8	0.03659	6.5	17	6
	1.3	Local: district, village, rural district	0.07729	8.5	0.06707	7	16	11
	1.4	Local: industrial zone of the enterprise	0.1014	14	0.128	12.5	21	21
IMPACT OBJECT	2.1	Public safety: long-term pollution of the environment, causing statistically recorded indicators of deterioration in the health of the population, threat to livelihoods	0.00966	14	0.0061	14	2	1
	2.2	Public health: environmental pollution, which may lead to a deterioration in the health of the population	0.03382	16	0.03659	20.5	7	6
	2.3	Individual natural components: water bodies, atmospheric air, soils, forests, etc.	0.04831	18.5	0.05488	22	10	9
	2.4	Natural resources: minerals, underground and surface waters, flora and fauna	0.08696	30	0.09146	25.5	18	15
ENVIRONMENTAL SITUATION IN THE PROJECT AREA	3.1	Extremely unfavourable: according to long-term observations, the state of the environment is assessed by environmental authorities as being extreme	0.01932	30	0.0122	29	4	2
	3.2	Unfavourable: indicators of the state of the environment or its individual components frequently exceed the maximum permissible values	0.04831	32.5	0.06098	29	10	10
	3.3	Generally favourable, but there are separate sources of pollution	0.09662	32.5	0.128	32.5	20	21
ENVIRONMENT	4.1	Surface water pollution	0.04831	33	0.04268	35	10	7



	4.2	Groundwater pollution	0.04831	33	0.04878	35	10	8
	4.3	Air pollution	0.00966	40.5	0	43.5	2	0
	4.4	Pollution by hazardous industrial waste	0.05314	45.5	0.04878	46	11	8
	4.5	Soil pollution	0.08696	49	0.1037	48	18	17
	4.6	Noise, vibration, odours	0.09662	49	0.1341	48	20	22
			<b>1</b>		<b>1</b>		<b>207</b>	<b>164</b>

## Conclusion

The article investigated the fundamental work of eminent scientists (López and Montalvo, 2015; Levidow et al., 2016; Lambrechts et al., 2019) regarding the methodology and methods used to evaluate innovative and eco-innovative projects and described the shortcomings of the existing guidelines in the literature and applied by the industry. The article presents a method by which to assess the feasibility and economic and environmental performance of eco-innovative projects. This model facilitates a comprehensive project assessment based on absolute positioning. The requirements for the assessment and the selection models of eco-innovation projects and the tasks in the field of their modernization are formulated in order to adapt to the world and modern economic relations. For example, they consider the following:

- The need to build a hierarchical system of indicators corresponding to the levels of eco-innovation project management
- The need to consider the various contributions of indicators of different hierarchical levels (qualitative and quantitative) to the total integrated indicator of an eco-innovation project
- The impossibility of making an unambiguous assignment of a number of indicators to a particular class

Taking into account the stated requirements, the methodological guidelines have been developed to solve the problems associated with evaluating the effectiveness of investing in eco-innovative projects during competitive selection.

An appropriate decision-support system provides a program-target approach using comprehensive experience in assessing eco-innovation projects in terms of such parameters as innovation, competitiveness, and eco-efficiency. This decision-support system is designed for use by the expert commissions responsible for venture capital funds, development institutions, and other potential investors who need to select appropriate eco-innovation projects.

Competition among companies in a market economy generally takes the form of project competition, and the ability of a company to compete directly in a specific project market depends on the competitiveness of its project innovation. Modeling methods are based on the judgment that an assessment of the competitiveness of an economic entity can be made by assessing the competitiveness of its eco-projects: the greater the competitiveness of such projects, the greater the competitiveness of the enterprise. Various methods can be used to find this ratio. A brief description of the most common is given below:

- The undoubted advantages of this approach include the fact that it considers one of the most important components of an enterprise's competitiveness: the competitiveness of its eco-innovative projects. Indeed, it is difficult to imagine a successful enterprise that does not have a portfolio of competitive innovative projects.

- A disadvantage is that the competitive strength of projects is still not identical to the sustainable competitive advantage of an enterprise since competitors quickly copy any price or quality advantages of innovative projects, and consequently their economic benefits rapidly disappear. Also, there are some complaints due to the reduction of project competitiveness according to the assessment of the price-quality ratio, which does not consider the degree of its innovativeness and which is of great importance in positioning the project in the market.

In addition, the application of the considered group of methods requires comparison to similar innovative projects. At the same time, the development of commodity-money relations leads to ever-more-aggravating differences in the economic conditions of enterprises, their ever-increasing diversification, and the ever-greater differentiation of projects and services. It is becoming increasingly difficult to determine the clear geographical boundaries of a particular market and to establish a list of competing projects, leading to the low applicability of such methods for assessing an enterprise's competitiveness.

However, the main disadvantage of this approach is that it only allows one to gain a very limited understanding of the advantages and disadvantages of the enterprise since the measure of its competitiveness hinges on the competitiveness of innovative projects and thus does not consider other aspects of its activities. After all, the competitiveness of such projects reflects the level of demand for innovation, and the competitiveness of an enterprise reflects the level of business efficiency.

## References

- Abdrakhmanova, M., Mutanov, G., Mamykova, Z., & Tukeyev, U. (2018). Agents Interaction and Queueing System Model of Real Time Control of Students Service Center Load Balancing. *Lecture Notes in Computer Science* (including subseries *Lecture Notes in Artificial Intelligence* and *Lecture Notes in Bioinformatics*), 11055 LNAI, 349-359 (pp. 349-359). [https://doi.org/10.1007/978-3-319-98443-8\\_32](https://doi.org/10.1007/978-3-319-98443-8_32)
- Adamczyk, M., Betlej, A., Gondek, J., Ohotina, A. 2019. Technology and sustainable development: towards the future?, *Entrepreneurship and Sustainability Issues*, 6(4), 2003-2016. [http://doi.org/10.9770/jesi.2019.6.4\(32\)](http://doi.org/10.9770/jesi.2019.6.4(32))
- Atari, S., Bakkar, Y., Olaniyi, E. O., Prause, G. 2019. Real options analysis of abatement investments for sulphur emission control compliance. *Entrepreneurship and Sustainability Issues*, 6(3), 1062-1087. [http://doi.org/10.9770/jesi.2019.6.3\(1\)](http://doi.org/10.9770/jesi.2019.6.3(1))
- Bente Villadsen, M. J. (2017). Discounted Cash Flow Models. In M. J. Bente Villadsen, *Risk and Return for Regulated Industries* (pp. 97-116). Academic Press.
- Bohdaniuk, O., Buriak, R., Savchuk, V. 2019. Competitiveness of horticultural products as a precondition of industry development. *Entrepreneurship and Sustainability Issues*, 6(4), 1587-1601. [https://doi.org/10.9770/jesi.2019.6.4\(3\)](https://doi.org/10.9770/jesi.2019.6.4(3))
- Bringer, J. D., Johnston, L. H., & Brackenridge, C. H. (2006). Using computer-assisted qualitative data analysis software to develop a grounded theory project. *Field methods*, 18(3), 245-266.
- Carrillo-Hermosilla, J., Del Río, P., & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of cleaner production*, 18(10-11), 1073-1083. <https://doi.org/10.1016/j.jclepro.2010.02.014>.
- Cluzel, F., Yannou, B., Millet, D., & Leroy, Y. (2016). Eco-ideation and eco-selection of R&D projects portfolio in complex systems industries. *Journal of Cleaner Production*, 112, 4329-4343. <https://doi.org/10.1016/j.jclepro.2015.08.002>.
- Cornell University, INSEAD, and WIPO (2018). *The Global Innovation Index 2018: Energizing the World with Innovation*. Ithaca, Fontainebleau, and Geneva.
- Dudin, M.N., Ivashchenko, N.P., Gurinovich, A.G., Tolmachev, O.M., Sonina, L.A. 2019. Environmental entrepreneurship: characteristics of organization and development. *Entrepreneurship and Sustainability Issues*, 6(4), 1861-1871. [http://doi.org/10.9770/jesi.2019.6.4\(22\)](http://doi.org/10.9770/jesi.2019.6.4(22))

- Dutra, C. C., Ribeiro, J. L. D., & de Carvalho, M. M. (2014). An economic–probabilistic model for project selection and prioritization. *International Journal of Project Management*, 32(6), 1042-1055. <https://doi.org/10.1016/j.ijproman.2013.12.004>.
- Eddelani, O., El Idrissi, N. E., Monni, S. 2019. Territorialized forms of production in Morocco: provisional assessment for an own model in gestation, *Insights into Regional Development* 1(1): 6-18. [https://doi.org/10.9770/ird.2019.1.1\(1\)](https://doi.org/10.9770/ird.2019.1.1(1))
- Huang, X., Zhao, T., & Kudratova, S. (2016). Uncertain mean-variance and mean-semivariance models for optimal project selection and scheduling. *Knowledge-Based Systems*, 93, 1-11.
- Jeng, D. J. F., & Huang, K. H. (2015). Strategic project portfolio selection for national research institutes. *Journal of Business Research*, 68(11), 2305-2311.
- Karasakal, E., & Aker, P. (2017). A multicriteria sorting approach based on data envelopment analysis for R&D project selection problem. *Omega*, 73, 79-92.
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32(5), 232-240.
- Lambrechts, W., Gelderman, C. J., Semeijn, J., & Verhoeven, E. (2019). The role of individual sustainability competences in eco-design building projects. *Journal of Cleaner Production*, 208, 1631-1641. <https://doi.org/10.1016/j.jclepro.2018.10.084>
- Leach, T. H., Winslow, L. A., Acker, F. W., Bloomfield, J. A., Boylen, C. W., Bukaveckas, P. A., ... & Farrell, J. L. (2018). Long-term dataset on aquatic responses to concurrent climate change and recovery from acidification. *Scientific data*, 5, 180059. doi: 10.1038/sdata.2018.59 (2018).
- Levidow, L., Lindgaard-Jørgensen, P., Nilsson, Å., Skenhall, S. A., & Assimacopoulos, D. (2016). Process eco-innovation: assessing meso-level eco-efficiency in industrial water-service systems. *Journal of Cleaner Production*, 110, 54-65. <https://doi.org/10.1016/j.jclepro.2014.12.086>
- López, F. J. D., & Montalvo, C. (2015). A comprehensive review of the evolving and cumulative nature of eco-innovation in the chemical industry. *Journal of cleaner production*, 102, 30-43. <https://doi.org/10.1016/j.jclepro.2015.04.007>
- Montalvo, C., Diaz-Lopez, F., & Brandes, F. (2011). Eco-innovation Opportunities in Nine Sectors of the European Economy. European Sector Innovation Watch. European Commission, Directorate General Enterprise and Industry, Brussels.
- Mutanov, G. (2015). *Mathematical Methods and Models in Economic Planning, Management and Budgeting* (p. 364). Springer Berlin Heidelberg.
- Mutanov, G., Milosz, M., Kozhanova, A. (2018). Systematically dynamic model-building approach of oil company. *Journal of Engineering and Applied Sciences*, 13 (10), 3396-3401. <http://medwelljournals.com/abstract/?doi=jeasci.2018.3396.3401>
- Mutanov, G., Milosz, M., Saxenbayeva, Z., & Kozhanova, A. (2018). Investments Decision Making on the Basis of System Dynamics. *Studies in Computational Intelligence*, (769), 293-303. [https://doi.org/10.1007/978-3-319-76081-0\\_25](https://doi.org/10.1007/978-3-319-76081-0_25)
- Padhy, R. K., & Sahu, S. (2011). A real option based Six Sigma project evaluation and selection model. *International Journal of Project Management*, 29(8), 1091-1102. <https://doi.org/10.1016/j.ijproman.2011.01.011>
- Reid, A., & Miedzinski, M. (2008). Eco-innovation: final report for sectoral innovation watch. SYSTEMATIC Eco-Innovation Report.
- Scarpellini, S., Valero-Gil, J., & Portillo-Tarragona, P. (2016). The “economic–finance interface” for eco-innovation projects. *International Journal of Project Management*, 34(6), 1012-1025. <https://doi.org/10.1016/j.ijproman.2016.04.005>
- Shvetsova, O.A.; Rodionova, E.A.; Epstein, M. Z. 2018. Evaluation of investment projects under uncertainty: multi-criteria approach using interval data. *Entrepreneurship and Sustainability Issues*, 5(4), 914-928. [http://doi.org/10.9770/jesi.2018.5.4\(15\)](http://doi.org/10.9770/jesi.2018.5.4(15))
- Stone, P. J., Dunphy, D. C., & Smith, M. S. (1966). The general inquirer: A computer approach to content analysis.

Triebswetter, U., & Wackerbauer, J. (2008). Integrated environmental product innovation in the region of Munich and its impact on company competitiveness. *Journal of Cleaner Production*, 16(14), 1484-1493. <https://doi.org/10.1016/j.jclepro.2007.09.003>

Tvaronavičienė, M. 2018. Towards sustainable and secure development: energy efficiency peculiarities in transport sector. *Journal of Security and Sustainability Issues*, 7(4), 719-725. [https://doi.org/10.9770/jssi.2018.7.4\(9\)](https://doi.org/10.9770/jssi.2018.7.4(9))

Woodrum, E. (1984). "Mainstreaming" content analysis in social science: Methodological advantages, obstacles, and solutions. *Social Science Research*, 13(1), 1-19.

Yin, S., Ding, S. X., Xie, X., & Luo, H. (2014). A review on basic data-driven approaches for industrial process monitoring. *IEEE Transactions on Industrial Electronics*, 61(11), 6418-6428.

Zhao, J., Yang, Y., Zhao, Q., & Zhao, Z. (2017). Effects of ecological restoration projects on changes in land cover: A case study on the Loess Plateau in China. *Scientific reports*, 7, 44496.

Žižlavský, O. (2014). Net present value approach: method for economic assessment of innovation projects. *Procedia-Social and Behavioral Sciences*, 156, 506-512.

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## MODELLING THE CROWDFUNDING TECHNOLOGY ADOPTION AMONG NOVICE ENTREPRENEURS: AN EXTENDED TAM MODEL

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**Abstract.** Computer-mediated crowdfunding is deemed as a financial innovation technology used by novice entrepreneurs to solicit funds from other individuals in order to easily gather fundraising for their innovative ideas. However, lack of information on the attributes of crowdfunding platforms coupled with the lack of the knowledge about the techniques of use of these technologies make this fundraising tool not very effective. In this study, we try to elucidate key factors influencing the intention of Tunisian entrepreneurs to adopt crowdfunding platforms as a main tool of fundraising. The research model was based on an extended Technology Acceptance Model (TAM) with the integration of three new variables: perceived risk with service, perceived risk with transaction and plagiarism risk. The results show that, both perceived risk with service, perceived risk with transaction and plagiarism risk have a negative impact on entrepreneurs' use of crowdfunding platforms, while perceived usefulness and perceived trust influence positively entrepreneurs' intention behavior. Perceived risks with crowdfunding service and transaction are affected by financing risk, security concerns and psychological factors, while plagiarism risk is influenced by information concerns and perceived control.

**Keywords:** Crowdfunding, risk, trust, TAM

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**Additional disciplines:** information and communication

### 1. Introduction

It is broadly recognized that crowdfunding has radically metamorphosed the entrepreneurial finance ecosystem. It is defined as an open call over an Internet platform for financial resources in the form of a monetary donation, an exchange for a future product, service, or reward (Kleemann et al., 2008; Belleflamme et al., 2011). Commonly, crowdfunding uses web technologies and especially e-payment platforms to facilitate electronic transactions between entrepreneurs requesting funds and crowdfunders giving funds. Crowdfunding platforms, such as Ulule,

Indiegogo and Kickstarter, give the opportunities, to raise funding, for young entrepreneurs by pitching an innovative idea to their social network.

Asking money from the crowd still in contradiction with classical fundraising ways such as securing funding from banks, venture capitalists and business angels. In fact, novice entrepreneurs create their profiles on a crowdfunding platform and clarify their monetary objectives, planning of funds' use, and schedule for objectives attainment.

Nowadays, there is an exponential growth in the number of crowdfunding websites. According to the study reported by the University of Cambridge and KPMG (2016), 5.431 billion euros were exchanged in 2015 in Europe on specialized platforms including 4.412 billion in the United Kingdom alone (Cambridge/KPMG, 2016). As a result, all European countries have a regulatory framework dedicated to crowdfunding phenomenon. However, the United States and Asia are major players in crowdfunding. Investments were worth 33.6 billion euros and 94.6 billion euros respectively in 2015. Indeed, Terry et al. (2015: 8) consider crowdfunding as "potentially the most disruptive of all the new models of finance," with the World Bank (2015) predicting that crowdfunding investments will be a \$96 billion a year market in developing countries alone by 2025.

In the other side of the world, Africa still the lowest performing crowdfunding markets (Chirisa & Mukarwi, 2018). In Africa, crowdfunding is a challenge hindered by the lack of legal texts supporting it. Within this framework, crowdfunding is deemed as a new opportunity that can enable funding transfer from donators or investors to entrepreneurs looking for raise funding (Pazowski & Czudec, 2014).

This study is expected to be of substantial interest to both researchers and entrepreneurs. From the academic side, this paper not only makes contributions to research on crowdfunding, however, practically, the results suggest new insight for crowdfunding technology adoption by novice entrepreneurs in order to promote the development of crowdfunding.

## **2. Literature Review**

Crowdfunding owes its origin to the concept of crowdsourcing that means the outsourcing of problem-solving tasks to a distributed network of individuals (Howe, 2006). Crowdfunding makes it possible for those with limited access to traditional sources of financial backing, such as banks or venture capitalists, to acquire financial resources necessary to pursue their projects. Through online transactions, crowdfunding also gives people with disposable income a new way to give to others and "invest" in projects that might not happen without their financial support.

Crowdfunding has arisen as an unconventional source of raise funding for different types of entrepreneurial projects and as one of the most interesting tool of Internet finance (Li et al., 2016). In fact, within a crowdfunding campaign, the novice entrepreneurs describe their entrepreneurial projects, choose the appropriate funding instrument and fixe a funding objective and the financial contribution of each funder, as well as the reward of each one of them (Mollick, 2014).

There are four different types of crowdfunding: rewards-based crowdfunding, donation-based crowdfunding, Equity crowdfunding, and lending crowdfunding (Ahlers et al., 2015). In rewards-based crowdfunding platforms such as Kickstarter and Indiegogo, crowdfunders pay small amounts of money in exchange for a reward, which is often the produced item. In donation-based crowdfunding, crowdfunders donate deliberately small amounts without any reward. Usually donation-based crowdfunding platforms are used to raise money for a non-profit or a cause. However, lending platforms and equity platforms are distinguished. In the first case, crowdfunders lend



money to entrepreneurs and make profits with interest. In the second case, investors take shares in the new start-up seeking raise funding.

Crowdfunding has widely stimulated the interest of researchers in business management. In fact, there are various publications dealing with themes such as crowdfunders' motivations for crowdfunding (Bretschneider et al., 2014) and identifying key factors for a raise funding campaign (Belleflamme et al., 2013). Conversely, there is no studies have been conducted on the factors influencing the acceptance of using crowdfunding platforms neither by entrepreneurs nor by fundraisers in developing countries which are deprived of this technology. For example, Lei et al. (2018) found that potential funders' decision-making process is influenced by different types of uncertainty and risks associated to entrepreneurs' project. In fact, in traditional e-commerce consumers buy a finished product, inversely for funders via crowdfunding platforms, they buy a product that is not yet to be finished. This generates an uncertainty based on perceived trust, perceived risk and perceived usefulness among both novice entrepreneurs who are worry about their project disclosure and funders who are worry about their funds being misappropriated or diverted. While Risk perception theory (RPT) provides a consistent view of subjective risk, we think that adjustments are necessary because researchers have argued that the explanatory power of a theory have to be contingent on the technology's features (Featherman & Pavlou, 2003). In this paper, we take into account the plagiarism risk as mediating variables in addition to risk with services and risk with transaction.

Other studies have also confirmed that information disclosure on the crowdfunding platforms reduces information asymmetry (Mollick, 2014) and increases also the probability of raise funding accomplishment (Ahlers et al., 2015). Nevertheless, there is no previous empirical studies has been performed to identify factors of the intention to use voluntary crowdfunding platforms by novice entrepreneurs in developing countries where crowdfunding platforms are still absent. The aim of our current study was to investigate factors influencing the acceptance of using crowdfunding platforms among Tunisian entrepreneurs. We lead a study among 100 novice entrepreneurs hosted in 12 different business incubators.

### **3. Theoretical framework and hypotheses**

Many researchers have proposed several models of technology acceptance in order to predict users' intention of a specific technology. The measurement of both user experience and satisfaction of several new technological tools have a very interesting importance, especially at the recent shutdown of Google Glass project (Shin & Hwang, 2017). This essential defy stimulated different researchers to propose many acceptance models of technology by potential users. In fact, Fishbein & Ajzen (1977) and Davis (1989) have proposed and verified their theories, and models of the intention to use of technologies. Explicitly, our theoretical framework should referred to the following models and theories:

- Technology Acceptance Model - TAM (Davis, Bagozzi, Warshaw, 1989),
- Theory of Planned Behavior -TPB (Fishbein & Ajzen, 1977),
- Innovation Diffusion Theory - IDT (Moore and Benbasat 1991),
- Motivational Model (Davis, Bagozzi, and Warshaw 1992),
- Combined Model of TAM and TPB (Taylor & Todd, 1995),
- Social Cognitive Theory (Compeau & Higgins, 1995),
- TAM 2 (Venkatesh & Davis, 2000),
- Unified Theory of Acceptance and Use of Technology or UTAUT (Venkatesh et al. 2003),
- TAM 3 (Venkatesh & Bala, 2008).

In this context, many authors carried out various studies dealing deeply with comparative analysis of theories and models of technology acceptance (Venkatesh et al., 2003; Roca & Gagné, 2008; Shin & Biocca, 2017; Jaziri & Touhami, 2018). Moreover, TAMs, have particular attention in the research area of technology adoption. TAM allows us to predict behavioral intention as dependent variables. As our research aims to explore the determinants of crowdfunding technology adoption by Tunisian novice entrepreneurs, we think that TAM associated with

theories of perceived risk and trust could estimate the behavioural intention to use crowdfunding platforms. In fact, Researches overseas confirm that perceived risk and trust are two crucial variables of crowdfunding adoption. Furthermore, as crowdfunding is a new technology not applied yet in Tunisia, TAM can be considered as suitable to study the acceptance of using crowdfunding platforms by entrepreneurs.

With the widespread of web 2.0 technology, many researchers have applied and adjusted the TAM to this environment. Bomil & Han (2002:248) highlighted that perceived usefulness and perceived ease of use are not sufficient to predict the intention to use technology. In fact, security and privacy are two other important considerations for a user (Luarn & Lin., 2005). Therefore, we adopt three mediating variables related to risk especially: perceived risk with crowdfunding service, perceived risk with online crowdfunding transaction (Lee et al., 2001) and Plagiarism Risk. On the other hand, we adopt one mediating variable related to “perceived trust” (Malhotra et al., 2004).

In order to predict the willingness to use crowdfunding platforms (UCP) by Tunisian novice entrepreneurs, we use simultaneously perceived usefulness and both Perceived Risk and Perceived Trust theories as theoretical basis. All these mediating variables can be illustrated in the proposed research model in Figure 1.

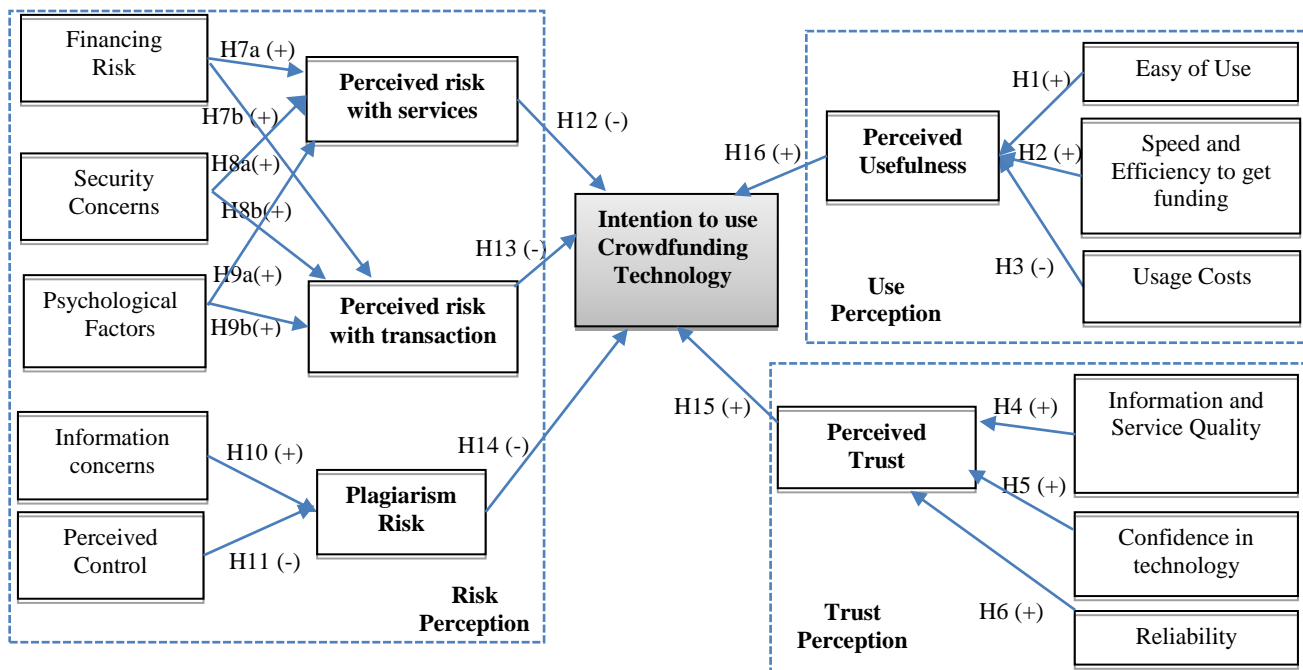


Figure 1. Research model.

Source: authors

### 3.1. Mediating variables

Usage of crowdfunding technology is the final dependent variable. Three key principles drive the usage of these platforms i.e. how useful it is for novice entrepreneur to use this technology, how much risk is involved in terms of security concerns and given the risk involved can trust still be built upon for entrepreneurs to use crowdfunding platforms.

**Perceived Usefulness (PU)**

Davis (1993) defined Perceived Usefulness as “the degree to which an individual believes that using a particular system would enhance his or her job performance”. Moreover, he defined the attitude toward use of a technology as “the degree to which an individual evaluates and associates the target system with his or her job” (p. 476). Accordingly, this study proposes the following hypothesis:

H16: Crowdfunding platform will get a positive impetus if perceived useful

Davis (1989) recognises two different constructs, Perceived Ease of Use (EU) and Perceived Usefulness (PU). These two latent constructs affect directly the attitude of an individual toward the target technology use and affect indirectly the use of actual system use (Davis, 1993: 477).

Perceived Ease of Use as “the degree to which an individual believes that using a particular system would be free of physical and mental effort”. Adams et al. (1992) replicated the research of Davis (1989) to validate these scales that are determined by four beliefs: easy to learn, controllable, easy to become skilful and clear and understandable. Accordingly, this study proposes the following hypothesis:

H1: Ease of use (EU) has positive impact on the intention to use crowdfunding platforms

Referring to the five dimensions of Perceived usefulness proposed by Adams et al. (1992), we recognized as usefulness categories related to crowdfunding service: get funding more quickly, job performance, increase productivity, effectiveness and make fund raising easier. Crowdfunding platforms allows novice entrepreneurs to have direct access to funders and avoid bureaucratic procedures of ordinary financial institutions. Crowdfunding technology increases entrepreneur’s chances to get funding especially those who have not access to traditional funding institutions (Banks, Venture Capital, etc.). In addition, crowdfunding platforms could increase the project productivity in case the collected funds exceed the requested amount. In a crowdfunding campaign, the novice entrepreneur is required to introduce his idea and convince the investors to be engaged effectively in his project. The entrepreneur is in direct relation with crowdfunders and he is more implicated and more efficient in his fundraising. Procedures of a crowdfunding campaign are easier and simpler compared to those of obtaining credit from other funding institutions.

Speed and Efficiency (SE) of crowdfunding platforms as it uplifts the performance of getting funding quickly is positively impacts adoption of this technology. The efficiency of crowdfunding systems would involve handling sophisticated platforms, thereby adding value to the entrepreneurs. Therefore, this paper proposes the following hypothesis:

H2: Speed and Efficiency to get funding has a positive influences perceived usefulness in crowdfunding.

The voluntary information disclosure by the entrepreneur increases the confidence of crowdfunders, helps public investors to make better capital allocation decisions, and lowers firms’ capital costs (Wang et al., 2015). Therefore, this paper proposes the following hypothesis:

H3: Usage costs (UC) is associated negatively with the perceived usefulness of crowdfunding platforms.

**Perceived trust (PT)**

Zheng et al., (2016) defined trust as a sentiment of security and the disposition to depend on someone or something. Trust is considered as a dynamic process and is built over a certain period of time contributing to satisfaction beyond the effects of the economic outcome (Fam et al., 2004, p. 198). Chen (2006) argued that perceived trust has two means. The first it is a belief, attitude, confidence, or an expectation about honesty of another party’s (the funders’ trustworthiness in our case). The second consider trust as a behavioral intention including uncertainty. Therefore, this paper proposes the following hypothesis:

H15: Perceived trust (PT) has positive impact on the intention to adopt crowdfunding.

Furthermore, there are three basic dimensions of perceived trust namely: Information and service quality (ISQ), confidence in technology (CT) and reliability (REL) (Kim et al., 2011). According to Zheng et al., (2000) trust is achieved by regular use of reward-based crowdfunding technology. Accordingly, this study proposes the following hypothesis:

H4: Information and service quality has positive effect on perceived trust.

H5: Confidence in technology has positive impact on perceived trust.

H6: Reliability is positively related to perceived trust.

#### **Perceived risk with service (PRS)**

Bauer (1960) was the first to introduce the concept of “perceived risk” to marketing literature. Since 1960, extensive researches have shown that perceived risk affects the behaviour across different cultures. The theory of perceived risk explains that people perceive risk because they face uncertainty and potentially undesirable consequences, so they expect some kind of loss.

Therefore the more risk they perceive the less likely they will intend to try the service. Gierczak et al., (2014) argues that dependence on sources of information reduce crowdfunders’ perceived risk with the crowdfunding service adoption. Wang et al., (2018), show from a risk-perception view the concerns of fundraisers’ voluntary information disclosure on crowdfunding platforms.

Fundraisers make decisions regarding crowdfunding services to buy. The results of fundraising are often uncertain and the entrepreneur perceives the risk in making a purchase decision. The degree of risk that fundraisers perceive and their own tolerance for risk taking are factors that influence their adoption of crowdfunding platforms. Therefore, this paper proposes the following hypothesis:

H13: Perceived risk with crowdfunding services (PRS) is associated negatively with the intention to use crowdfunding platforms.

Among the five risk categories proposed by Jacoby & Kaplan (1974) and confirmed by Park et al. (2004), we recognized as risk types related to crowdfunding service: functional loss, time loss, financial loss and opportunity loss. Crowdfunding platforms could not function as expected because of technical problems or wrong manipulation. In the rewards-based crowdfunding campaigns such as “All-or-Nothing” (AON), entrepreneurs risk wasting time in case they do not reach the target amount before the deadline of the campaign. As crowdfunding websites are relatively new phenomenon, there is still no guarantee regarding the credibility and the seriousness of the platform transactions. With professional investors such as business angels and venture capitalists, ideas are disclosed in a relatively small circle of investors, each of whom may incur reputational costs from stealing ideas. In contrast, in a crowdfunding campaign entrepreneurs should disclose their entrepreneurial idea in the internet before the product is actually produced making ideas tealing and replicability more likely. This practice stands in sharp contrast with concerns of many entrepreneurs who pursue that innovative ideas need to remain undisclosed. Fundraisers’ perceptions of financing risk rise. Accordingly, the following hypotheses are proposed:

H7a: Perceived monetary concerns especially financing risk (FR) is positively related to perceived risk with crowdfunding services.

H8a: Security concerns (SC) is associated positively with perceived risk with crowdfunding services.

H9a: psychological factors (PF) has positive effect on perceived risk with crowdfunding services.

#### **Perceived risk with transaction (PRT)**

Several studies have suggested the lack of security and privacy over an electronic transaction as a frequently recognized obstacle to the use of information and communication technology (Rose et al. 1999; Swaminathan et al. 1999; Lee et al., 2000). Novice entrepreneurs are proposing a plan built around "micro-investors" that they think would minimize the risk of “fraudfunding” (Hazen, 2012). However, fundraising is conditioned by the entrepreneur’s disclosure of his project idea to investors. Entrepreneurs face transaction risks such as the lack of security, stealing his idea and privacy concerns. Therefore, this paper proposes the following hypothesis:

H12: Perceived risk with transaction (PRT) via crowdfunding platform is negatively related to the intention of use of this technology.

Perceived risk with transaction is determined by the following dimensions: Privacy, security and non-repudiation. Rose et al. (1999) noted that privacy is vulnerable because messages on the Internet are being passed in a shared domain, and consumers are not yet comfortable with sending personal information across Internet. Moreover, Swaminathan et al. (1999) argued that security concerns with respect to exposure personal information to hackers or unknown individuals, is still a major anxiety for consumers. The possibility that a part can deny an agreement after the transaction represents a risk for entrepreneurs. Accordingly, the following hypotheses are proposed:

H7b: Perceived monetary concerns especially financing risk (FR) is positively related to perceived risk with transaction via crowdfunding platform.

H8b: Security concerns (SC) is associated positively with perceived risk with transaction via crowdfunding platform.

H9b: psychological factors (PF) has positive effect on perceived risk with transaction via crowdfunding platform.

### **Plagiarism Risk (PR)**

The construct of Plagiarism risk (PR) is a belief that negatively impacts entrepreneur idea disclosure (Dinev et al., 2006). In our study, plagiarism risk is considered as an obstacle to information disclosure about the entrepreneurial project, which can lead to project abortion and loss of comparative advantages (Bulgurcu et al., 2010; Xu et al., 2013). In a crowdfunding campaigns, information related to the originality of the entrepreneurial project are critical and are very important for fundraisers. The loss of principal information could hinder the project's concretization of fundraisers (Li et al., 2016). When entrepreneurs divulge information about their entrepreneurial project on crowdfunding platforms, they incur the plagiarism risk or the illegal imitation of their original information by unscrupulous users. In this case, novice entrepreneurs will vacillate to disclose information related to their entrepreneurial projects on the crowdfunding platforms. Therefore, this paper proposes the following hypothesis:

H14: Plagiarism risk (PR) is negatively related to the intention of use of crowdfunding platforms.

Information concerns (IC) are considered as an interesting construct in preceding research on information revelation via social media (Xu et al., 2013). In crowdfunding context, it involves fundraisers' concern about threats to disclose their project's information online and incur the risk of information leakage (Dinev et al., 2006). Bulgurcu et al., (2010) argue that social media users are becoming more and more concerned with the security of their personal information revelation. As a result, as entrepreneurs' information worries rise, their perceptions of plagiarism risk increase. Therefore, we propose the following hypothesis:

H10: Information concerns (IC) have a positive impact on plagiarism risk (PR).

Perceived control (PCL) is another construct representing how much control entrepreneur have over who can perceive their information (Zlatolas et al., 2015). In their empirical study Xu et al., (2008) have shown a negative relationship between Perceived control and information risk. Analogically if fundraisers have more control of their Project's information they divulge, they perceive less risk (Krasnova et al., 2010). Consequently, entrepreneurs want to control who can evaluate their personal information. In fact, as entrepreneurs' control over disclosed information grow their plagiarism risk perception decrease (Xu et al., 2008). Accordingly, this paper proposes the following hypothesis:

H11: Perceived control (PCL) is negatively associated with plagiarism risk (PR).



## 4. Research methodology

### 4.1. Measurement development

For the operationalization of constructs, we chose to adapt existing validated measurement items identified from the reviewed literature (see Table 1), introducing only slight changes to make them pertinent in the context of crowdfunding. The measurement items were formulated as a five point Likert scale, ranging from 1 ‘strongly agree’ to 5 ‘strongly disagree’. As the measurement items were initially generated in English, we translate the questionnaire in French and Arabic language by adapting standard procedure of translation. Five colleagues in entrepreneurship and entrepreneurial finance who are familiar with survey conception and crowdfunding issues have evaluated the questionnaire. Furthermore, the questionnaire was pre-test by 10 PhD students in entrepreneurship through snowball sampling. The questionnaire testers were asked to comment any vague items, which are subsequently refined. As web based surveys are appropriate when the target are internet users and a short time of responses is required, the participants were first contacted via e-mail and provided an online web link to the questionnaire (Lee et al., 2001). Firstly, the questionnaire was sent by mail to 288 entrepreneurs incubated and hosted in 24 Tunisian business incubators, but the response rate was so low (2.3%). Four weeks later, the questionnaire was sent again to entrepreneurs that did not initially respond which improve the response rate to 10.8%. Thirdly, we boost the response rate to 27.98% by using phone calls. Finally, since an empirical evidence shows that incentives boost participation in the online survey (Li et al., 2006; Zlatolas et al., 2015) we decide to offer pre-paid mobile phone cards as gifts for respondents. Consequently, the final rate of response to the questionnaire was 72.22% (208 of 288 entrepreneurs). According to Hair et al. (2006), using structural equation modeling (SEM) requires a sample size between 200 and 400 to obtain precise results. In addition, Kline (2016) argued that the sample size for SEM should be larger than 200.

The collected test data were used for the exploratory factor analysis (EFA) and reliability analysis with SPSS 25.0. The result of data analysis indicated that the stability coefficients and Cronbach’s alphas exceeded 0.7 for the remaining 47 measurement items (Table 1).

**Table 1.** Measurement items

Construct	Code	Items	References
Information concern	IC	I am concerned that unauthorized people may access my project’s information. I am concerned that the crowdfunding platform is collecting too much of my project’s information. I am concerned that the crowdfunding platform may share my project’s information in an inaccurate manner.	Xu et al. (2013)
Perceived control	PCL	I believe that I have control over how the crowdfunding platform uses my project’s information. I believe that I have control over who can access my project’s information that I post on the crowdfunding platform. I believe that I have control over the project information that is visible to others on the crowdfunding platform.	Xu et al. (2008)
Plagiarism risk	PR	I perceive a real threat to my project, such as plagiarism and abuse on the crowdfunding platform. I fear that my project will be illegally copied by individuals or organizations without my consent. Overall, I’m afraid that there will be intellectual property disputes in the future operation of my project.	Malhotra et al. (2004)
Perceived Risk with services	PRS	I would find crowdfunding platforms services risky	Lee et al., (2001)
Perceived Risk with transaction	PRT	I would find crowdfunding platforms' transactions risky	Lee et al., (2001)
Financing risk	FR	My project will not attract investors	Featherman &



		The crowdfunding platform may not help me obtain adequate investments within the pre-set time limit.	Pavlou (2003)
Security Concerns	SC	Considering the current level of financing performance of the crowdfunding platform, my financing process will be somewhat difficult. I believe that my confidential information is kept secure There is an appropriate procedure in crowdfunding platform to prevent accidental loss of data When using crowdfunding platform, I am sure that certain managerial and technical procedures exist to protect my personal information In crowdfunding platform, if a certain transaction is performed, it never could be denied by party	Lee et al., (2001) Taherdoost (2017) Taherdoost & Sahibuddin (2015)
Psychological factors	PF	Usage of crowdfunding platforms seems inherently risky to me I lack confidence and perceive risk in crowdfunding platform since platform itself does not promote it	Tan & Teo, (2000)
Perceived usefulness	PU	Using a crowdfunding platform would enable me to get funding more quickly Using a crowdfunding platform would improve my chances to get funding Using a crowdfunding platform would increase the productivity of my project in case the funds collected exceed the requested amount Using a crowdfunding platform would enhance my effectiveness on getting funding	Davis (2003)
Ease of use	EU	Using a crowdfunding platform would make it easier for me to get funding It would be easy for me to learn how to use a crowdfunding platform I would find it easy to get a crowdfunding platform to do what I want it to do It would be easy for me to remember how to use a crowdfunding platform My interaction with a crowdfunding platform would be clear and understandable	Suh & Han (2003)
Speed and efficiency	SE	I do not find Crowdfunding technology time consuming With crowdfunding platform, I am on- the-go and can have funds with the touch of a button	Taherdoost (2018)
Usage cost	UC	I am not reluctant to use crowdfunding platform because I can not support any charge in case of failure of the campaign I am not reluctant to use crowdfunding platform because Crowdfunding platform's owner charges me for using it	
Perceived trust	PT	Crowdfunding platforms have integrity	Malhotra et al., 2004
Information and service quality	ISQ	Crowdfunding platforms are reliable Crowdfunding platforms are trustworthy Crowdfunding does not annoy me even if I have to remember different passwords or codes It would be easy to surf and access different services in crowdfunding platforms In crowdfunding platforms "how to use guides" are provided on the website	Malhotra et al., 2004
confidence in crowdfunding technology	CT	I prefer launching a crowdfunding campaign rather than raising funds directly from my acquaintances	Malhotra et al., 2004
Reliability	REL	I trust the current generation of online services including crowdfunding platforms Using crowdfunding technology enhance correct transaction records Using crowdfunding technology enhance zero-error in services	Malhotra et al., 2004
Intention to use	UC	Overall speaking, the effect of using crowdfunding platforms makes me feel satisfied I predict I would use crowdfunding platforms in the near future I plan to use crowdfunding platforms in the near future My intention would be to use crowdfunding platforms rather than traditional financing tools	Wu, Tao, and Yang (2008) Venkatesh et al. (2003),

Information about the respondents' demographics are listed in Table 2. The demographic characteristics of our sample shows different demographic factors, including gender, age, business activity, diploma and education background.

**Table 2.** Sample demographics (n=208).

Measures	Items	Frequency	Percentage %
Gender	Male	132	63.46
	Female	76	36.54
Age	Under 30	134	64.42
	30-40	56	26.92
	40 or above	18	8.66
Educational level	Bachelor	113	54.33
	Master	21	10.1
	Engineering	69	33.17
	PhD	5	2.4
Educational background	Human sciences	12	5.76
	Computer sciences	141	67.78
	Medical sciences	4	1.92
	Business & Economics	46	22.11
	Tourism Management	5	2.40
Business activity	Services	79	37.98
	Industry	125	60.09
	Agriculture	4	1.92

## 5. The results

This study outlines a research model with five latent constructs, each of them was measured by three or more variables. Data analysis was carried out using SEM as a flexible tool in scrutinising causal relationships between multiple-item constructs (Kline, 2016). The benefits of SEM analysis consist of assumptions that are more flexible and fewer measurement errors permitted by several indicators per construct (Kline, 2016). Before testing our research model, we performed manipulation to validate the treatment. We use a two-step process to specify a measurement model in the confirmatory factor analysis (CFA), then we test our latent structural model established from the measurement model (Anderson & Gerbing, 1988).

### 5.1. Measurement model validation.

The 208 responses used for data analysis indicate a satisfactory sample size about 72.22%. We use confirmatory factor analysis (CFA) to assess our measurement model and to ensure validity and reliability (Brown, 2015). Overall goodness-of-fit indices for the initial measurement model showed that the fit was acceptable, with the chi-square/df ratio ( $\chi^2/d.f.$ ) of 1.76, root-mean-squared error of approximation (RMSEA= 0.05), comparative fit index (CFI= 0.93), goodness of fit index (GFI=0.92), adjusted goodness of fit index (AGFI=0.92), normed fit index (NFI=0.94), Bollen's incremental-fit index (IFI=0.95), comparative fit index (CFI=0.95) all having acceptable fit levels.

To evaluate the reliability of the constructs we calculate Cronbach's  $\alpha$  and in order to measure internal consistency we determine composite reliability (CR) (Fornell & Larcker, 1981). In fact, for a construct to have good reliability, Cronbach's  $\alpha$  should be superior to 0.7, while internal consistency (CR) should be at least 0.7 (Hair et al., 1998). The Table 3 indicates a good reliability and shows that all values exceeded generally accepted values. Construct validity includes convergent validity and discriminant validity. Convergent validity measures whether items effectively reflect their corresponding factors (Brown, 2015).

**Table 3.** Standardized item loadings, AVE, CR and Cronbach's  $\alpha$  values.

Constructs	Items	Standardized item loading	CR	AVE	Cronbach's $\alpha$
Perceived usefulness	<i>PU4</i>	0.858	0.8742	0.7341	0.850
	<i>PU2</i>	0.846			
	<i>PU5</i>	0.838			
	<i>PU1</i>	0.836			
	<i>PU3</i>	0.822			
Perceived trust	<i>PT1</i>	0.932	0.9565	0.8871	0.946
	<i>PT3</i>	0.928			
	<i>PT2</i>	0.907			
Plagiarism risk	<i>PR2</i>	0.836	0.8432	0.6564	0.824
	<i>PR3</i>	0.834			
	<i>PR1</i>	0.828			
Financing risk	<i>FR2</i>	0.886	0.8675	0.7332	0.843
	<i>FR3</i>	0.866			
	<i>FR1</i>	0.843			
Psychological factors	<i>PF2</i>	0.941	0.942291	0.8339	0.944
	<i>PF1</i>	0.886			
Security concerns	<i>SC1</i>	0.849	0.8291	0.8124	0.921
	<i>SC2</i>	0.831			
	<i>SC3</i>	0.829			
	<i>SC4</i>	0.812			
Information concerns	<i>IC2</i>	0.879	0.9246	0.7967	0.881
	<i>IC1</i>	0.866			
	<i>IC3</i>	0.857			
Percived control	<i>PC3</i>	0.885	0.9132	0.7614	0.842
	<i>PC1</i>	0.862			
	<i>PC2</i>	0.854			
Speed and efficiency	<i>SE1</i>	0.887	0.9321	0.7753	0.832
	<i>SE2</i>	0.874			
Usage costs	<i>UC1</i>	0.867	0.9426	0.7821	0.863
	<i>UC2</i>	0.843			
Reliability	<i>REL1</i>	0.891	0.9365	0.7859	0.857
	<i>REL2</i>	0.873			
Easy of use	<i>EU1</i>	0.876	0.9115	0.7525	0.832
	<i>EU3</i>	0.871			
	<i>EU4</i>	0.866			
	<i>EU2</i>	0.852			
Information & service quality	<i>ISQ1</i>	0.892	0.9203	0.7731	0.844
	<i>ISQ2</i>	0.879			

Confidence in technology	<i>CT1</i>	0.873	0.9119	0.7648	0.832
	<i>CT2</i>	0.857			
Intention to use	<i>IU1</i>	0.966	0.9674	0.8984	0.958
	<i>IU2</i>	0.957			
	<i>IU3</i>	0.931			
	<i>IU4</i>	0.912			

In this study we use average variance extracted (AVE) to assess the convergent and discriminant validity of the constructs' measurement. To confirm convergent validity, the factor loading of every item should be superior to 0.7, and each construct should have the CR value larger than 0.7, and the AVE value greater than 0.5 (Fornell & Larcker 1981). As presented in Table 3, all factor loadings for the items are greater than 0.7 and were significant at the 0.001 level, all AVEs are superior than 0.5 and the CRs exceeded 0.7. Consequently, the scale showed good convergent validity. Therefore, to measure if two factors are significantly different we use discriminant validity (Kline, 2016).

Discriminant validity is shown when:

1. measurement items load more strongly on their assigned construct rather than on the other constructs in the CFA, and
2. the square root of the Average Variance Extracted (AVE) of each construct is greater than its correlations with the other constructs (Hair et al., 1998).
3. As shown in Table 4, the square root of the AVE for each construct is greater than the correlation shared among constructs in the research model, thus providing evidence of discriminant validity.

**Table 4.** The square roots of AVEs and factor correlation coefficients.

Construct	PU	EU	SE	UC	PT	ISQ	CT	REL	PRS	PRT	FR	SC	PF	PR	IC	PC	UCT
PU	<b>.843</b>																
EU	.157**	<b>.929</b>															
SE	.028*	.107**	<b>.956</b>														
UC	-.097**	-.068*	.003*	<b>.930</b>													
PT	.056*	.065*	.052*	-.045*	<b>.927</b>												
ISQ	.037*	-.160***	.051*	.056*	.087*	<b>.903</b>											
CT	.676**	.437***	.249**	.097*	.236***	.074*	<b>.824</b>										
REL	.094*	.171***	.083*	-.385***	.024*	.748**	.165**	<b>.814</b>									
PRS	-.065*	-.050*	-.048*	-.267*	-.020*	.316**	-.029*	-.314***	<b>.876</b>								
PRT	-.066*	-.045*	-.061*	-.345*	-.012*	.015*	.618***	-.702***	.613***	<b>.872</b>							
FR	.088*	-.172***	.062*	.367**	.125**	.736**	.154**	.084*	-.058*	-.078*	<b>.924</b>						
SC	.076*	-.043*	-.038*	.267***	-.014*	.315**	-.021*	-.312***	.084*	.284***	.076*	<b>.842</b>					
PF	.056*	-.040*	-.037*	.255***	-.010*	.302**	-.018*	-.052*	.234***	-.302***	.062*	.028*	<b>.886</b>				
PR	-.043*	-.038*	-.029*	.041*	-.022*	.408**	-.039*	-.302***	-.405***	-.617***	-.052*	.092*	.382***	<b>.866</b>			
IC	-.052*	-.031*	.027*	.035*	-.710***	.602**	-.018*	.082*	-.533***	-.408***	.072*	.402***	.052*	.612***	<b>.901</b>		
PC	-.557*	.052*	.045*	.052*	-.018*	.021*	-.026*	.302***	.038*	-.516***	-.161**	.324***	.077*	.531***	.432***	<b>.943</b>	
UCT	.046*	.065*	-.037*	-.456***	-.062*	.014*	-.037*	-.302***	-.336***	-.403***	.031*	.301***	.063*	-.712***	.157***	.138***	<b>.837</b>

\*, p<0.05; \*\*, p<0.01; \*\*\*, p<0.001.

Note: Values on diagonal are the square root of Average Variance Extracted (AVE) between the constructs and their measures.

However, off-diagonal values are correlations between constructs.

## 5.2. Structural model validation

After obtaining an acceptable measurement model, we apply a structural equation modelling approach to test our hypotheses described in our research model. The structural model is a tool to detect if the proposed conceptual model was providing an acceptable fit to the empirical data. Table 5 compares between the recommended and actual values of the fit indices. With the chi-square/df ratio ( $\chi^2/df$ ) of 1.74, root-mean-squared error of approximation (RMSEA= 0.04), comparative fit index (CFI= 0.93), goodness of fit index (GFI=0.91), adjusted goodness of fit index (AGFI=0.91), normed fit index (NFI=0.94), Bollen's incremental-fit index (IFI=0.96), comparative fit index (CFI=0.96) all indicating that the model have an acceptable fit to data as suggested by Kline (2016).

**Table 5** Comparison of model fit indices for measurement model and structural model.

Fit indices	Criterion	Measurement model		Structural model
		Initial model	Respecified model	
$\chi^2/df$	<3.00	1.76	1.67	1.74
GFI	>0.9	0.92	0.91	0.91
AGFI	>0.9	0.92	0.91	0.91
NFI	>0.9	0.93	0.95	0.94
IFI	>0.9	0.95	0.97	0.96
CFI	>0.9	0.93	0.97	0.96
RMSEA	<0.06	0.05	0.04	0.04

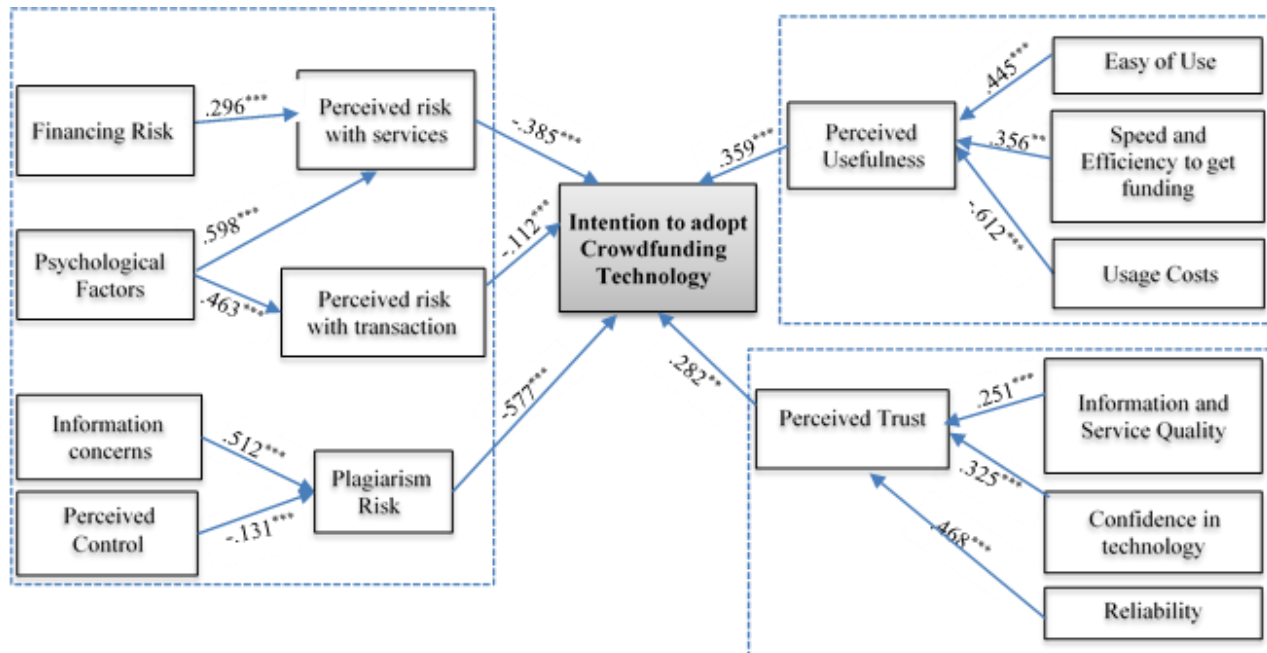
Table 6 and figure 2 show findings of the structural model analysis. The majority of the paths are significant and are in the expected direction. The path coefficients of hypotheses 1, 3, 4, 5, 6, 7a, 7b, 9a, 9b, 10a, 10b, 12, 13, 14 and 16 were significant at a level of  $p<0.001$ , indicating support for these hypotheses. The path coefficient of hypothesis 2 and 15 was significant at a level of  $p<0.01$ , thus indicating support for this hypothesis. However, hypotheses 8a and 8b were rejected. According to the results, Plagiarism risk has a larger direct influence on intention to adopt crowdfunding technology ( $\beta = -.577$ ,  $p<0.001$ ) followed by Perceived risk with services ( $\beta = -0.385$ ,  $p<0.001$ ), Perceived usefulness ( $\beta = 0.359$ ,  $p<0.001$ ) and Perceived risk with transaction ( $\beta = -0.112$ ,  $p<0.001$ ). Interestingly, information concerns were found to have the largest direct influence ( $\beta = 0.512$ ,  $p<0.001$ ) on plagiarism risk, followed by perceived control ( $\beta = -0.131$ ,  $p<0.001$ ). Therefore, psychological factors have a direct influence on both perceived risk with services ( $\beta = 0.598$ ,  $p<0.001$ ) and perceived risk with transaction ( $\beta = 0.463$ ,  $p<0.001$ ). Thus, Financing risk have a direct influence on both perceived risk with services ( $\beta = 0.296$ ,  $p<0.001$ ) and perceived risk with transaction ( $\beta = 0.147$ ,  $p<0.001$ ). In addition, usage costs have a larger direct influence on Perceived usefulness ( $\beta = -0.612$ ,  $p<0.001$ ) followed by Ease of use ( $\beta = 0.445$ ,  $p<0.001$ ) and Speed & efficiency ( $\beta = 0.356$ ,  $p<0.01$ ). However, Reliability ( $\beta = 0.465$ ,  $p<0.001$ ), followed by Confidence in technology ( $\beta = 0.325$ ,  $p<0.001$ ) and Information and service quality ( $\beta = 0.251$ ,  $p<0.001$ ), have the largest direct influence on perceived trust (Figure 2).

**Table 6.** Results of hypothesis testing

No.	Hypothesized path	Estimate	S.E.	C.R.	P value
H12	Perceived risk with services → intention to use	-.385	.016	-8.618	.000***
H13	Perceived risk with transaction → intention to use	-.112	.013	-6.486	.000***
H14	Plagiarism risk → intention to use	-.577	.067	-5.534	.000***
H16	Perceived usefulness → intention to use	.359	.046	15.643	.000***
H15	Perceived trust → intention to use	.282	.018	7.644	.006**
H10a	Information concerns → Plagiarism risk	.512	.023	12.188	.000***
H10b	Perceived control → Plagiarism risk	-.131	.012	-11.432	.000***
H7a	Financing risk → Perceived risk with services	.296	.017	10.617	.000***
H8a	Security concerns → Perceived risk with services	.186	.014	.045	.565 <sup>ns</sup>
H9a	Psychological factors → Perceived risk with services	.598	.013	8.834	.000***
H7b	Financing risk → Perceived risk with transaction	.147	.027	12.163	.000***
H8b	Security concerns → Perceived risk with transaction	.284	.029	1.486	.990 <sup>ns</sup>
H9b	Psychological factors → Perceived risk with transaction	.463	.013	18.631	.000***
H1	Ease of use → Perceived usefulness	.445	.015	17.623	.000***
H2	Speed and efficiency → Perceived usefulness	.356	.029	6.221	.004**
H3	Usage costs → Perceived usefulness	-.612	.068	-7.661	.000***
H4	Information and service quality → Perceived trust	.251	.014	5.748	.000***
H5	Confidence in technology → Perceived trust	.325	.012	6.316	.000***
H6	Reliability → Perceived trust	.468	.019	8.812	.000***

\* : p<0.05; \*\* : p<0.01; \*\*\* : p<0.001; <sup>ns</sup>: not significant.

**Figure 2.** The validated structural model





## 6. Discussion

Plagiarism risk has negative effects on intention to adopt crowdfunding platforms ( $\beta = -0.577$ ,  $p < 0.001$ ), showing that it is a critical determinant of acceptance to use of crowdfunding technology owing to the entrepreneur's fear of voluntary information disclosure. This result is in accordance with previous studies (Wang et al., 2018), which have argued that entrepreneurs as fundraisers are worried about the originality or the design of their project to be illegally copied by unethical users without their prior notification or agreement. Consequently, the intention to use crowdfunding platform will decrease if they recognize a high risk of plagiarism (Stutzman et al., 2011). Undeniably, the risk taken by a novice entrepreneur may influence its funding choices. As a result, various studies have evidenced risks of idea-stealing related to the often required circulation of ideas (Biais & Perotti, 2008), such problem is qualified by Cooter & Edlin (2013) as "double trust dilemma of innovation" (Schwienbacher, 2017). Perceived risk with services ( $\beta = -0.385$ ,  $p < 0.001$ ) and perceived risk with transaction ( $\beta = -0.112$ ,  $p < 0.001$ ) was found to have a negative effect on voluntary use of crowdfunding platforms by Tunisian entrepreneurs. Furthermore, psychological factors have a direct influence on both perceived risk with services ( $\beta = 0.598$ ,  $p < 0.001$ ) and perceived risk with transaction ( $\beta = 0.463$ ,  $p < 0.001$ ). This result means that entrepreneurs' cognition of risk and their intention to use crowdfunding services are influenced by their psychological schemes. This finding is in line with the results obtained by Hollenbaugh & Ferris (2014), who found that online users adopt technology services to disclose their information based on extrinsic motivations. In the same way, entrepreneurs (fundraisers) believe to run an unsuccessful crowdfunding campaign once they share online information about their entrepreneurial project. Thus, they know for a fact that if they do not share details about their projects to fascinate potential funders, they cannot be entirely funded. Consequently, voluntary adoption of crowdfunding platforms depends on both risk perception with services and transaction upon crowdfunding platforms in such a way a higher risk perception with services discourage willingness to use this technology and to disclose project details voluntarily.

Information concerns were found associated positively with plagiarism risk ( $\beta = 0.512$ ,  $p < 0.001$ ), showing that it plays an important role in the intention to use of crowdfunding technology. This result is consistent with the study of Bulgurcu et al. (2010) indicating a relation between information concern which, is considered as a personal disposition and privacy risk. This result indicates that if information concerns are high, entrepreneurs will be interested to protect their entrepreneurial project from plagiarism and therefore will be less willing to use crowdfunding platform.

Perceived control was found to have a negative influence on plagiarism risk ( $\beta = -0.131$ ,  $p < 0.001$ ). This finding is in accordance with prior studies in the social networking service (SNS) testing the link between perceived control and information revelation (Zlatolas et al., 2015). Risk concerns about the revelation of sensitive project details can be reduced by different uses of information control. This result shows that when entrepreneurs have control on the use of their entrepreneurial project information, they become less worried about the stealing risks of their project proposals.

Financing risk was found associated positively with both perceived risk with services ( $\beta = 0.296$ ,  $p < 0.001$ ) and perceived risk with transaction ( $\beta = 0.147$ ,  $p < 0.001$ ). This result is consistent with the study conducted by Nanda & Rhodes-Kropf, (2016) indicating that financing risk encompasses the possible failure to find future funding for novice entrepreneurs. When entrepreneurs launch a crowdfunding campaign, they may also fear financing risk. Thus, entrepreneurs could be unable to attain their financing objective owing to the revelation of irrelevant information related to their entrepreneurial project (Nanda and Rhodes-Kropf, 2016). In fact, if entrepreneurs as fundraisers did not arouse the interest of crowdfunders as investors, they may ask themselves if they have disclosed enough relevant information (Li et al., 2016). As a result, to satisfy crowdfunders' expectations and fascinate them, entrepreneurs may divulge more information about their entrepreneurial projects. Consequently, a high perceived risk with crowdfunding services and transaction usually results in more financing risk perception.

Usage costs was found related negatively to Perceived usefulness ( $\beta = -0.612$ ,  $p < 0.001$ ). This finding is in line with previous studies indicating that usage costs have acted as an obstacle to technology acceptance (Park & Kim, 2016; Yu, 2012). Many researches argued that usage costs and technology adoption are associated negatively according to adoption risks model (e.g., Zhou, 2011; Venkatesh et al., 2012). Some platforms claim a significant percentage (more than 10%) of raised funds as commission for their services. While the crowdfunding service is perceived to be useful by entrepreneurs, usage costs will influence the usage intention as an adoption obstacle.

Perceived easy to use has a positive relationship ( $\beta = 0.445$ ,  $p < 0.001$ ) and direct effect with perceived usefulness of entrepreneurs to use crowdfunding technology. In addition, Perceived usefulness has an immediate effect on the intention to use crowdfunding platforms ( $\beta = 0.359$ ,  $p < 0.001$ ). This finding is consistent with the studies conducted by Bin Mohd & Thaker (2018) and Bin Mohd et al., (2018) showing both perceived usefulness and perceived ease of use are directly significant in influencing the crowdfunder's intention to adopt the crowdfunding-waqf model (CWM) in Malaysia. In the same way, speed and efficiency was found associated positively with perceived usefulness ( $\beta = 0.356$ ,  $p < 0.01$ ). This result is in line with the study of Taherdoost (2018) indicating that speed affect positively the acceptance of e-service technology.

Reliability was found have the largest positive affect on perceived trust ( $\beta = 0.465$ ,  $p < 0.001$ ), followed by Confidence in technology ( $\beta = 0.325$ ,  $p < 0.001$ ) and Information and service quality ( $\beta = 0.251$ ,  $p < 0.001$ ). These findings are consistent with recent studies (Esraa et al., 2018; Wangari & Karugu, 2018) indicating that customers trust online services' platforms because their confidence in technology, reliability and the quality of the provided information and service. Wang et al., (2018) talk about the increasing of trust if there is ready access to information and services. The information and service quality should facilitate the ease of use of crowdfunding service applications.

The relationship between Security concerns and Perceived risk with services was not verified ( $\beta = 0.186$ ,  $p = 0.565$ ). In addition, the relationship between Security concerns and Perceived risk with transaction was not confirmed ( $\beta = 0.284$ ,  $p = 0.990$ ). This result is not consistent with that of the study conducted by Nikkhah et al. (2018). One plausible explanation is that crowdfunding in Tunisia is still at an embryonic stage of development; thus, fundraisers may place much security concerns than entrepreneurs in using crowdfunding platform as they are the true fund purveyors. Moreover, entrepreneurs have no fear about the security of transferring fund from the fundraiser account to the platform.

## Conclusions and implications

### Theoretical implications

This study makes many contributions to the literature on crowdfunding technology adoption among novice entrepreneurs. First, while technology adoption is a very interesting research issue and has been widely studied, the topic has not been thoroughly investigated in the context of crowdfunding. However, existing literature on the use of crowdfunding platforms focus essentially on voluntary information disclosure by entrepreneurs (Li et al., 2016), thus neglecting the importance of crowdfunding technology adoption in the context of developing country where this funding tool is underdeveloped. Our current research fills this knowledge gap. This contribution aimed at investigating the factors affecting entrepreneurs' behavior intention to use crowdfunding platforms from a perspective of three distinct perception: use, trust and risk. To the best of our knowledge, this empirical study is among the first researches to scrutinize the determinants of entrepreneurs' behavior intention of voluntary use of crowdfunding platforms in developed country.

Second, prior studies on technology adoption have often focused only on the classic TAM model as their theoretical foundation. However, risk perception with service, transaction and plagiarism was neglected. Entrepreneurs are reticent about using crowdfunding platforms to disclose information related to their entrepreneurial project because of different types of perceived risks. Consequently, perceived risk appears as a

conspicuous obstacle to entrepreneurs' information disclosure behavior (Wang et al., 2015; Li et al., 2016; Wang et al., 2018). Thus, this research provides some of the first evidence for the basic validity of the classic TAM model. The findings show that perceived risks affect crowdfunding adoption among novice entrepreneurs and specially their information disclosure behavior. The application of a modified TAM model to a study of crowdfunding adoption expands the understanding of risk perception in explaining entrepreneurs' behavior.

Third, the current study provided evidence to clarify the three dimensions of risk perceptions in the context of crowdfunding especially. We divided perceived risk into perceived risk with services, perceived risk with transaction and plagiarism risk, which are supposed to form the essential of risk perceptions when an entrepreneur uses crowdfunding platform and discloses information about his entrepreneurial project. However, most of the carried studies regarding TAM model have considered perceived risk with other factors as an integral variable to explore user's behavior intention. TAM model was extended in this research by exploring different risks on entrepreneurs' intention to use crowdfunding platforms and their information disclosure behavior. Furthermore, we revealed the interesting role of plagiarism risk in predicting entrepreneurs' intention to adopt crowdfunding technology.

### **Practical implications**

From a practical level, findings of this study can serve as a guide to entrepreneurship educators and counsellors on how to understand entrepreneurs' behaviour intention to use crowdfunding platforms. In addition, results will support crowdfunding services providers to determine the significant variables encouraging entrepreneurs' voluntary intention to adopt crowdfunding technology and to disclose information when running a crowdfunding campaign. Crowdfunding service providers have to be conscious that developing the appropriate strategies depends on both individual and contextual factors of their environment. Our findings indicate that entrepreneurs should expect differences in risk perceptions depending on their personality traits and their psychological factors. Explicitly, plagiarism risk and financing risk affect significantly entrepreneurs' intention to use crowdfunding platforms and to disclose voluntarily information of their entrepreneurial project. Consequently, crowdfunding services providers have to be aware of these risks to enhance entrepreneurs' behaviour to adopt this technology. Entrepreneurs may be vexed by disclosing their entrepreneurial project information. Thus, they require more guarantees for confidentiality of their project information. As a result, crowdfunding platforms should be customised to provide such guarantees to entrepreneurs when posting their project information on crowdfunding platforms. Perceived control is an additional interesting topic that have to be addressed. A perceived level of control over shared information increases the ability and the confidence of entrepreneurs as fundraisers to manage it and then reduces their perceptions of plagiarism risk. Crowdfunding services providers have to assure confidentiality on their platforms to encourage entrepreneurs divulging their project information according to their intention. The perceived control of entrepreneurs over their project information will increase, if they can choose which information is observable and share or retract freely their project's information.

In addition, innovative entrepreneurs can construct a competitive advantage and differentiate themselves from competitors. Nevertheless, innovative projects involved higher levels of plagiarism risk. Deterring imitation using legal barriers such as patent, copyrights, trademarks are a very interesting concern for both entrepreneurs and Crowdfunding service providers when uploading project's information on the crowdfunding platform. Therefore, to resolve these problems, crowdfunding service providers can remind entrepreneurs of their delicate information and assist them to patent their product. For the meantime, crowdfunding service providers have to tighten procedures of project evaluation and strengthen its operations management.

Considering the significant impact of perceived usefulness and perceived trust on entrepreneurs' intention behavior, crowdfunding service providers should express and publish procedures, policies and security measures of their platforms utilization to standardize entrepreneurs' information revelation behavior. Crowdfunding service providers should enforce online security tools and include exhaustive reports on their platforms to protect rights

of their users. They can explain which information will be revealed and which is optional. As a result, crowdfunding service providers must increase the perceived usefulness and enhance the perceived trust.

### Limitations and suggestions for future research

TAM model is used to detect human resistance for adopting new technologies and its robustness was confirmed by several studies. It explains and predicts IT acceptance and facilitate design changes before users have experience with a system (Dongwon Lee et al. 2001. P: 110). However, the findings of this study have some limitations that will provide opportunities for further research. First, our empirical study is restricted to a Tunisian entrepreneurs' sample. It is wiser to test whether the findings are valid in other developing countries. Thus, we should take into account both cultural, social and technological differences between countries. A very important extension of this research would be to compare entrepreneurs' intention to use crowdfunding platforms and their willingness to disclose project's information in different developing countries to scrutinize whether the important factors differ. Another future extension of this study would be to expand the data set to cover not only nascent entrepreneurs hosted in business incubator.

Second, other factors could influencing entrepreneurs' intention to use crowdfunding platforms that are not considered in the presented model. Future study can include to our model factors related to personal traits and demographic characteristics of entrepreneurs, which have been confirmed as effecting information disclosure on online services. Thus, further research may extend the TAM model by considering additional factors.

Third, the questionnaire data were collected from 208 entrepreneurs at a single point in time. A longitudinal study would more credibly investigate how entrepreneurs' intention to adopt crowdfunding technology changes over time.

### References

- Adams, D.A., Nelson, R.R., and Todd, P.A. (1992). "Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication", *MIS Quarterly* 16(2), pp. 227-247.
- Ahlers, G.K., Cumming, D., Günther, C. and Schweizer, D. (2015). "Signaling in equity crowdfunding", *SSRN Electronic Journal*, 39(4), pp. 955-980. <https://doi.org/10.1111/etap.12157>
- Ajzen, I., Fishbein, M. (1977). Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research, *Psychological bulletin*, 84(5), pp. 889-918.
- Bauer, R.A. (1960). "Consumer behavior as risk taking", *Proceedings of the 43<sup>rd</sup> National Conference of the American Marketing Association*, pp. 389-398.
- Belleflamme, P., Lambert, T., Schwienbacher, A. (2011). "Crowdfunding: Tapping the Right Crowd," in *International Conference of the French Finance Association (AFFI)*, May 11-13 <http://dx.doi.org/10.2139/ssrn.1578175>
- Belleflamme, P., Lambert, T., Schwienbacher, A. (2013). "Individual crowdfunding practices", *Venture Capital*, 15(40), pp. 313-333.
- Biais, B., Perotti, E. (2008), Entrepreneurs and New Ideas, *The RAND Journal of Economics*, 39(4), pp. 1105-1125
- Bin Mohd, M-A., Thaker, T., Pitchay, A-A. (2018). Modeling crowdfunders' behavioral intention to adopt the crowdfunding-waqf model (CWM) in Malaysia: The theory of the technology acceptance model, *International Journal of Islamic and Middle Eastern Finance and Management*, <https://doi.org/10.1108/IMEFM-06-2017-0157>
- Bin Mohd, M-A., Thaker, T. (2018). "Factors influencing the adoption of the crowdfunding-waqf model (CWM) in the waqf land development", *Journal of Islamic Marketing*, <https://doi.org/10.1108/JIMA-05-2016-0043>
- Bretschneider, U., Knaub, K. and Wieck, E. (2014), "Motivations for crowdfunding: What drives the crowd to invest in start-ups?" *Twenty Second European Conference on Information Systems*. <https://www.jstor.org/stable/25474413>
- Brown, T.A. (2015), *Confirmatory Factor Analysis for Applied Research*, 2nd edition, New York: The Guilford Press.
- Bulgurcu, B., Cavusoglu, H. and Benbasat, I. (2010), "Understanding emergence and outcomes of information privacy concerns: A case of Facebook", *International Conference on Information Systems*, St Louis.
- Cambridge Centre for Alternative Finance/KPMG (2016). 'Sustaining Momentum: The 2<sup>nd</sup> European Alternative Finance Industry Report, available at: <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2016/09/sustaining-momentum.pdf>



- Compeau, D-R, & Higgins, C-A. (1995). Computer Self-Efficacy: Development of a Measure and Initial Test, *MIS Quarterly*, 19(2), pp. 189-211
- Chirisa, I., Mukarwi, L/ (2018). *A Comparative Analysis of Africa and Chinese Crowdfunding Markets*, In, Benna, U-G. & Benna, A-U, *Crowdfunding and Sustainable Urban Development in Emerging Economies*, IGI Global.
- Craciun, G. (2018). Choice Defaults and Social Consensus Effects on Online Information Sharing: The Moderating Role of Regulatory Focus. *Computers in Human Behavior* <https://doi.org/10.1016/j.chb.2018.06.019>
- Davis, F-D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, *MIS Quarterly*, 13(3), pp. 319-340.
- Davis, F.D., Bagozzi, R.P., Warshaw, P-R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science*, 35(8), pp. 982-1003.
- Davis, F.D., Richard, P. Bagozzi, P.R. Warshaw (1992), Extrinsic and Intrinsic Motivation to Use Computers in the Workplace, <https://doi.org/10.1111/j.1559-1816.1992.tb00945.x>
- Dinev, T., Bellotto, M., Hart, P., Russo, V. et al. (2006). "Internet users' privacy concerns and beliefs about government surveillance: An exploratory study of differences between Italy and the United States", *Journal of Global Information Management*, 14(4), pp.57-93.
- Esraa, A. Yufei, Y., Milena, H. (2018). Understanding Trust in Online Reviews - Research in Progress. *SIGHCI 2018 Proceedings*. <https://aisel.aisnet.org/sighci2018/24>
- Featherman, M. and Pavlou, P. (2003). "Predicting e-services adoption: A perceived risk facets perspective", *International Journal of Human-Computer Studies*, 59(4), pp. 451-474. [https://doi.org/10.1016/S1071-5819\(03\)00111-3](https://doi.org/10.1016/S1071-5819(03)00111-3)
- Fornell, C. and Larcker, D.F. (1981). "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, 18(4), pp.39-50.
- Gierczak, M. M., Bretschneider, U. & Leimeister, J. M. (2014). Is all that Glitters Gold? Exploring The Effects of Perceived Risk on Backing Behavior in Reward-based Crowdfunding. In: *International Conference on Information Systems (ICIS)*, Auckland, New Zealand.
- Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998). *Multivariate Data Analysis*, 5th edition. New Jersey: Prentice-Hall.
- Hair, J.F., Black, B., Babin, B., Anderson, R.E. and Tatham, R.L. (2006). *Multivariate Data Analysis*, 6th ed., Prentice Hall, Upper Saddle River, NJ.
- Hollenbaugh, E. E. and Ferris, A. L. (2014). "Facebook self-disclosure examining the role of traits, social cohesion and motives", *Computers in Human Behavior*, 30(1), pp. 50 -58. <http://dx.doi.org/10.1016/j.chb.2013.07.055>
- Kaplan, L.B., Szybillo, G.J. and Jacoby, J. (1974). "Components of perceived risk in product purchase: A cross-validation", *Journal of Applied Psychology*, 59(3), pp.287-291. <http://dx.doi.org/10.1037/h0036657>
- Kim, M-J., Chung, N., Lee, C-K. (2011). The effect of perceived trust on electronic commerce: Shopping online for tourism products and services in South Korea, *Tourism Management*, 32, pp. 256–265. <http://dx.doi.org/10.1016/j.tourman.2010.01.011>
- Kleemann, F., Vob, G., Rieder, K. (2008). "Un (der) paid Innovators: The Commercial Utilization of Consumer Work through Crowdsourcing," *Science Technology and Innovation Studies*, 4, pp. 5-26.
- Kline, R.B. (2016). *Principles and Practice of Structural Equation Modeling*, 4th edition, New York: The Guilford Press.
- Krasnova, H., Spiekermann, S., Koroleva, K. (2010). "Online social networks: Why we disclose", *Journal of Information Technology*, 25(2), pp.109-125. <https://doi.org/10.1057/jit.2010.6>
- Kromidha, E. and Robson, P. (2016). "Social identity and signalling success factors in online crowdfunding," *Entrepreneurship & Regional Development*, pp.1-25. <https://doi.org/10.1080/08985626.2016.1198425>
- Li, D., Browne, G.J. and Chau, P.Y.K. (2006). "An empirical investigation of web site use using a commitment-based model", *Decision Sciences*, 37(3), pp. 427-444. <https://doi.org/10.1111/j.1540-5414.2006.00133.x>
- Li, X.C., Tang, Y.H., Yang, N.R., Ren, R.Y. et al. (2016). "The value of information disclosure and lead investor in equity-based crowdfunding: An exploratory empirical study", *Nankai Business Review International*, 7(3), pp.1-25. <https://doi.org/10.1108/NBRI-01-2016-0002>
- Lee, D., Park, J., Ahn, J. (2001), On the Explanation of Factors Affecting E-Commerce Adoption, *Proceedings of the 22nd International Conference on Information Systems*, New Orleans, Louisiana, pp. 109-120.
- Malhotra, N-K., Kim, S-S., Agarwal, J. (2004). Internet Users' Information Privacy Concerns (IUIPC): The Construct, the Scale, and a Causal Model, *Information Systems Research*, 15(4), pp. 336-355. <https://doi.org/10.1287/isre.1040.0032>
- Mollick, E. (2014). "The dynamics of crowdfunding: an exploratory study", *Journal of Business Venturing*, 29(1), pp.1-16. <https://doi.org/10.1016/j.jbusvent.2013.06.005>
- Moore, G.C., Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation, *Information Systems Research*, 2(3), pp. 192-222. <https://doi.org/10.1287/isre.2.3.192>

- Nanda, R. and Rhodes-Kropf, M. (2016), "Financing risk and innovation", *Management Science*, 63(4), pp. 901-918. <https://doi.org/10.1287/mnsc.2015.2350>
- Nikkhah, H-R., Grover, V., Sabherwal, R. (2018), Why Do Users Continue to Use Mobile Cloud Computing Applications? A Security-Privacy. *Proceedings of the 13th Pre-ICIS Workshop on Information Security and Privacy*, San Francisco, December 13, 2018
- Park, J-H., Kim, M-K. (2016), Factors influencing the low usage of smart TV services by the terminal buyers in Korea, *Telematics and Informatics*, <http://dx.doi.org/10.1016/j.tele.2016.01.001>
- Park, J., Lee, D., Ahn, J. (2004). Risk-Focused E-Commerce Adoption Model: A Cross-Country Study, *Journal of Global Information Technology Management*, 7:2, 6-30, <http://dx.doi.org/10.1080/1097198X.2004.10856370>
- Pazowski, P., & Czudec, W. (2014). Economic prospective and conditions of crowdfunding 1082-1083. Retrieved from <http://www.toknowpress.net/ISBN/978-961-6914-09-3/papers/ML14-685.pdf>.
- Roca, J-C., Gagne, M. (2008). Understanding e-learning continuance intention in the workplace: A self-determination theory perspective, *Computers in Human Behavior*, 24, 1585–1604. <https://doi.org/10.1016/j.chb.2007.06.001>
- Schwienbacher, A. (2017). Entrepreneurial risk-taking in crowdfunding campaigns, *Small Business Economics*, 51(4), pp 843–859. <https://doi.org/10.1007/s11187-017-9965-4>
- Stutzman, F., Capra, R. and Thompson, J. (2011), "Factors mediating disclosure in social network sites", *Computers in Human Behavior*, 27(1), pp. 590-598. <https://doi.org/10.1016/j.chb.2010.10.017>
- Swaminathan, V., Lepkowska-White, E., and Rao, B.P. (1999). "Browsers or Buyers in Cyberspace? An Investigation of Factors Influencing Electronic Exchange," *Journal of Computer Mediated Communication* 5(2) <https://doi.org/10.1111/j.1083-6101.1999.tb00335.x>
- Wang, S., Han, L., Gao, W. (2015). "Mandatory and voluntary information disclosure and the effects on financial analysts: Evidence from China", *Chinese Management Studies*, 9(3), pp. 425-440. <https://doi.org/10.1108/CMS-01-2015-0012>
- Wang, T., Liu, X., Kang, M., Zheng, H. (2018). Exploring the Determinants of Fundraisers' Voluntary Information Disclosure on Crowdfunding Platforms: A Risk-perception Perspective", *Online Information Review*, 42(3), pp. 324-342, <https://doi.org/10.1108/OIR-11-2016-0329>
- Wangari, M. J. & Karugu, J. (2018). Micro contextual characteristics and implementation of online banking system in Family Bank Limited. *International Academic Journal of Human Resource and Business Administration*, 3(4), pp. 291-314
- World Bank. (2015). *Crowdfunding in Emerging Markets: Lessons from East African Startups*, The World Bank Group 1818 H Street NW Washington, DC 20433.
- Rose, G., Khoo, H., and Straub, D.W. (1999). "Current Technological Impediments to Business-to Consumer Electronic Commerce," *Communications of the AIS* 1(16), pp 1-74.
- Shin, D., Hwang, Y. (2017). "Integrated acceptance and sustainability evaluation of Internet of Medical Things: A dual-level analysis", *Internet Research*, 27(5), pp.1227-1254, <https://doi.org/10.1108/IntR-07-2016-0200>
- Shin, D-H., Biocca, F. (2017). "Explicating user behavior toward multi-screen adoption and diffusion: User experience in the multi-screen media ecology", *Internet Research*, 27(2), pp. 338-361, <https://doi.org/10.1108/IntR-12-2015-0334>
- Suh, B, Han I. (2003). "The Impact of Customer Trust and Perception of Security Control on the Acceptance of Electronic Commerce", *International Journal of Electronic Commerce* <https://doi.org/10.1080/10864415.2003.11044270>
- Taherdoost, H. (2018). "Development of an adoption model to assess user acceptance of e-service technology: E-Service Technology Acceptance Model", *Behaviour & Information Technology*. <https://doi.org/10.1080/0144929X.2018.1427793>
- Taherdoost, H. (2017). "Understanding of E-Service Security Dimensions and its Effect on Quality and Intention to Use". *Information and Computer Security*, 25(5): 535–559. <https://doi.org/10.1108/ICS-09-2016-0074>
- Taherdoost, H., Sahibuddin, S. (2015), "A Review Paper on E-Service; Technology Concepts". *Procedia Technology*, 19: 1067–1074. <https://doi.org/10.1016/j.protcy.2015.02.152>
- Taylor, S., Todd, P-A. (1995). "Understanding Information Technology Usage: A Test of Competing Models", *Information Systems Research*, 6(2), pp. 144-176. <https://doi.org/10.1287/isre.6.2.144>
- Terry, H-P., Schwartz, D., Sun, T. (2015). "The future of finance: the socialization of Finance, Equity Research", Goldman Sach & Co, March 13, 2005, 62p.
- Venkatesh, V., Morris, M-C., Davis, G-B., Davis, F-D. (2003). "User Acceptance of Information Technology: Toward a Unified View", *MIS Quarterly*, 27(3), pp. 425-478. <https://doi.org/10.2307/30036540>
- Venkatesh, V., Thong, J.Y., Xu, X. (2012). "Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology". *MIS Quarterly*, 36(1), 157-178. <https://ssrn.com/abstract=2002388>
- Venkatesh, V., and Davis, F.D. (2000). "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science* 46(2), pp 186-204. <https://doi.org/10.1287/mnsc.46.2.186.11926>



- Venkatesh, V. (1999). "Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation," *MIS Quarterly*, 23(2), pp 239-260. <https://doi.org/10.2307/249753>
- Venkatesh, V., Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions, *Decision Sciences*, 39(2), 273-315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- Wu, Y-L., Tao, Y-H., Yang, P-C. (2008) The use of unified theory of acceptance and use of technology to confer the behavioral model of 3G mobile telecommunication users, *Journal of Statistics & Management Systems*, 11(5), pp. 919-949. <https://doi.org/10.1080/09720510.2008.10701351>
- Xu, F., Michael, K. and Chen, X. (2013). "Factors affecting privacy disclosure on social network sites an integrated model", *Electronic Commerce Research*, 13(2), pp.151-168. <https://doi.org/10.1007/s10660-013-9111-6>
- Xu, H., Dinev, T., Smith, H.J. and Hart, P. (2008). "Examining the formation of individual's privacy concerns: toward an integrative view", *Proceedings of the 29th International Conference on Information Systems*, pp.1-16.
- Yu, C.S. (2012). Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model. *Journal of Electronic Commerce Research*, 13(2), 104-121.
- Zheng, H., Hung, J-L., Qi, Z., Xu, B. (2016). "The role of trust management in reward-based crowdfunding", *Online Information Review*, 40(1), pp. 97-118, <https://doi.org/10.1108/OIR-04-2015-0099>
- Zhou, T. (2011). Examining the critical success factors of mobile website adoption. *Online Information Review*, 35(4), pp. 636-652.
- Zlatolas, L.N., Tatjana, W., Hericko, M. and Holbl, M. (2015). "Privacy antecedents for SNS self-disclosure: The case of Facebook", *Computers in Human Behavior*, 45(1), pp.158-167. <https://doi.org/10.1108/14684521111161972>

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## MODELING OF RESULTANT EFFECTS IN ASSESSMENT OF INNOVATIVE ACTIVITY OF THE HOTEL ORGANIZATIONS

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**Abstract.** Now much attention is paid to development of innovative and digital technologies, advance on the market of innovations of grocery, technological and also organizational and administrative character that result, as a rule, are resultant effects. The tourism industry – an important element of any economic system where resultant effects are shown especially brightly and visually, owing to continuous emergence of new requirements. The innovative activity of the hotel organizations in this context is of particular importance consisting in need of obtaining by them competitive advantages and fuller satisfaction of dynamically changing consumer demand for the tourist product made by them. To assess the innovative activity of organizations and its innovative competitiveness are widely used indicators of innovative activity of the organization. One of the main directions for the creation of quality services is the strict observance of the parameters of comfort, which are developed by the practice of the tourist business and are universal for hotels, catering facilities or a travel company. The most significant innovative technologies include the use of the Internet in order to promote and implement a tourist product and real competition for tourism organizations.

**Keywords:** resultant effect; innovative activity; hotel business; factorial model; stochastic count; indicators; assessment of innovative activity; hotel organizations

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**JEL Classifications:** L83, O32, O35, C15, C38

## 1. Introduction

Innovation activity in the hotel business causes not only the creation of qualitatively new business systems and the connections between their structural elements, but also the formation of a group of resulting effects.

The issues of evaluating the innovative activity of hotel organizations from the point of view of identifying the final results with appropriate efficiency are becoming ever more relevant (e.g. Panfiluk, Szymańska, 2017; Shevyakova et al. 2019; Chkalova et al. 2019). The objectives of this assessment, in our opinion, it is advisable to present in two plans (Anisimov Yu. P. et al. 2006; Vertakova, Yu.V. et al, 2012):

1) private assessment of the readiness of the hotel organization to implement a single innovation process;

2) an integral assessment of the current state of the hotel organization with respect to all or a group of innovative processes already being implemented.

The innovative potential is commonly understood as the measure of readiness to accomplish the tasks that ensure the achievement of the goals of innovation activity. Innovation sustainability is interpreted by us as the ability of an organization to preserve a predetermined level of achievement of a set of goals of innovation activity (quality and novelty of products or services sold, scientific and technical level of the material and technical structure, stability of resource provision, state of innovation potential, nature of innovation management) under the influence factors of a dynamically transforming market business environment. The intensity of innovation in this context characterizes the amount of expenditure of the enterprise, directed to the introduction of innovations to improve the production technology of the product or the provision of services.

## 2. Literature review

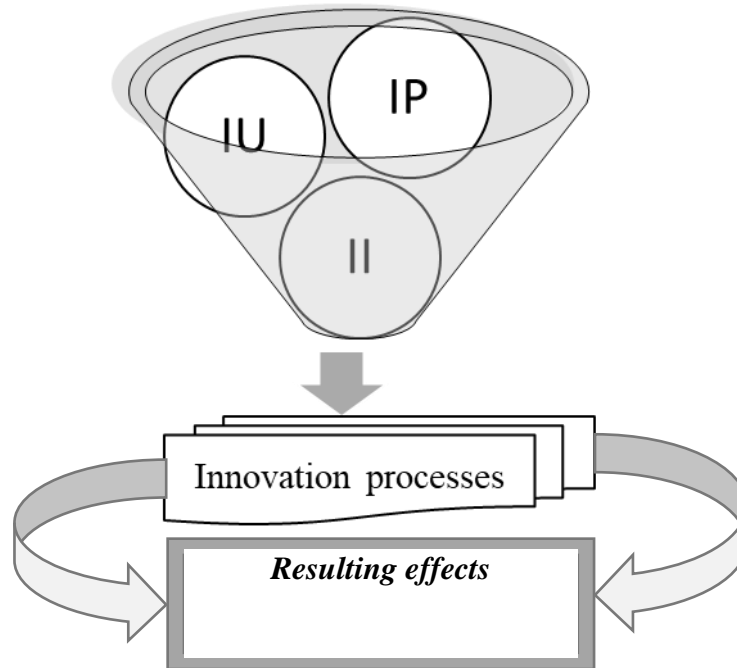
The study of the theory and practice of digitization of hotel organizations, digitalization in tourism is based in the numerous works, where the dynamics of development of technologies in the field of tourism is being examined. E.g. researchers Akaka, & Vargo (2014) wrote that they explored the role and scope of technology in value co-creation, service innovations and service systems — configurations of co-creation of technology value and people's offerings, tourist flows and the development of this sector were reviewed by Pröbstl-Haider (2014), Tarlow (2007), Medlik (2012). A study of the theory and practice of economic tourism processes based in Van der Wagen, & White (2018), Ryan (2012), Wells, & Smith (2014), Getz, & Page (2008) Backman (2018). Issues of socio-economic efficiency of diversification in tourism are highlighted in Battour, & Ismail (2016), Mohsin et al. (2016), Pertrenko et al. (2019). Issues of socio-economic efficiency digitalization, innovation processes in the field of tourism are highlighted in the works of Buhalis, & Low (2008), Munar (2012), Nikolova, Hassan (2013), Ziyadin, & Kabasheva (2018). They investigated the digitalization processes in the tourism industry. Researchers Ziyadin et al. (2019) reviewed the processes of diversification and digitalization in the field of tourism. Tarlow (2007) wrote in his work that tourism security is an important part of both security management and tourism. Pröbstl-Haider et al. (2014) described in his research the tourism industry that it offers a dedicated outlet for research relevant to social sciences and natural resources, all aspects of outdoor recreation planning and management, covering the entire spectrum of settings from wilderness. Medlik (2012) mentioned that *managing tourism* presents research studies that analyze the trends and information on the wide spectrum of tourism activities and industries.

## 3. Methodology

The development of innovative activity of the hotel organization as an integrated system can only be carried out through the development of its components (Bovin 2011). We have proposed a methodical approach to assessing the innovative activity of hotel organizations based on the modeling of the resulting effects in direct relation to specific innovation processes.

The resulting effects can be determined by the state of the aggregate of innovation processes:  $P = (P_1, P_2, \dots, P_n)$ . The state of each process depends on the state of the elements of innovation activity (EIA), in particular, innovation potential (IP), innovation sustainability (IS), intensity of innovation activity (AI), based on certain innovation processes (Beketov, 2008; Dezhkina 2012).

Innovative activity of hotel organizations can be schematically represented as follows (Figure 1).



**Figure 1.** Innovative activity of hotel organizations, creating the resulting effects

In evaluating innovation activity, the importance of the components is necessarily taken into account. The general scheme for assessing innovation activity is presented in Figure 2, where:

EIA (P) - compliance of elements of innovative activity with the implemented innovation processes;

P (EIA) - compliance of implemented innovation processes with elements of innovative activity;

PI (P) - compliance of the innovation potential of the totality of the implemented innovation processes;

PS (P) - compliance with the innovation sustainability of the totality of the implemented innovation processes;

AI (P) - compliance intensity of innovative activities of the totality of the implemented innovation processes.

		Innovation processes				
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>		
EIA	IP	P <sub>1</sub> (IP)	P <sub>2</sub> (IP)	P <sub>3</sub> (IP)	IP (P)	EIA (P)
	IU	P <sub>1</sub> (IU)	P <sub>2</sub> (IU)	P <sub>3</sub> (IU)	IU(P)	
	II	P <sub>1</sub> (II)	P <sub>2</sub> (II)	P <sub>3</sub> (II)	II(P)	
		P <sub>1</sub> (EIA)	P <sub>2</sub> (EIA)	P <sub>3</sub> (EIA)		
		P (EIA)				

**Figure 2.** Matrix “innovation processes - elements of innovation activity” of hotel organizations

Theoretical framework. All indicators characterizing the innovative activity of organizations are interrelated and interdependent. The connection between some of them is direct, and between others - indirect (Fathutdinov 2013).

To build a map of the interrelationships of the elements of innovation activity of hotel organizations, the main groups of indicators illustrating the characteristics of ongoing innovation processes were identified and used (N. Mariev, Savin 2010). The main indicators of the elements of innovation activity of hotel organizations and the formulas for their calculation are presented in Table 1.

**Table 1.** Indicators of elements of innovative activity of hotel organizations

EIA indicators	Calculation formula	Legend
Innovation potential		
Coefficient of innovation ICP staff	$ICp = \frac{IPQ}{APQ}$	IPQ - the total number of staff involved in innovation the activities of the enterprise, pers .; APQ - average number enterprise staff, pers.
Share of employees having a higher education in general HEPS staff	$HEPS = \frac{HEQ}{APQ}$	HEQ – the number of employees with higher education, pers .; APQ - average number enterprise staff, pers.
Share of employees having a degree in total DPS staff	$DPS = \frac{DPQ}{APQ}$	DPQ - the number of employees with academic degree, pers .; APQ - average number enterprise staff, pers.
Learning ratio TPC staff	$TPC = \frac{TPQ}{APQ}$	TPQ - the number of employees who passed training and retraining, pers .; APQ - average number enterprise staff, pers.
Intellectual factor IPRC property	$IPRC = \frac{INA}{NCA}$	INA - intangible assets, rub .; NCA - non-current assets, rub.
TPIC Hotel Services Innovation Ratio	$TPIC = \frac{VIIA}{EV}$	VIIA - volume of investments in innovative activity, rubles; EV - the total cost of the enterprise,
CREC equity ratio	$CREC = \frac{EC}{IS}$	EC - net worth, rub .; IS - total sources of funds (long-term and short-term), rub.
Coefficient turnover of funds in TRFA assets	$TRFA = \frac{SR}{ACA}$	SR - revenue from the sale of hotel services, rub .; ACA – average asset value, rub.
Innovative sustainability		
AUR autonomy ratio	$AUR = \frac{EC}{TB}$	EC - equity capital, providing innovation, rub .; TB - balance currency, rub.
The maneuverability of innovation MANR	$MANR = \frac{OCA}{EC}$	OCA - own circulating assets, providing innovative activity of the company; EC - net worth, rub .;
Profitability of hotel services HSP	$HSP = \frac{Res}{HSTC}$	Res - profit (loss) from sales of hotel services, rub .; HSTC - full cost price hotel services, rub.
PSR frame stability ratio	$PSR = \frac{DP}{APQ}$	DP number of employees with work experience at the enterprise for 5 and more years, people; APQ - average number

		enterprise staff, pers.
IGR innovation growth rate	$IGR = \frac{CIPr}{OEC}$	CIPr - cost of innovation processes, rub. ; OEC - the total cost of other investment expenses, rub.
Intensity of innovation activity		
The share of innovation financing in the revenue from the sale of hotel services IFS	$IFS = \frac{IFV}{HIS}$	IFV - the volume of financing innovation, rub. ; HIS - proceeds from the sale of hotel, RUB.
Share of financing of introduced innovations in the total amount of FII financed innovations	$FII = \frac{FIV}{TFI}$	FIV - the volume of financing of introduced innovations in the current year, rubles; TFI - the total amount of financed innovations in the current year, rub.
Coefficient changes in the sales volume of hotel services as a result of spending on CHSS innovation	$CHSS = \frac{SVe}{SVs}$	SVe - sales volume of hotel rooms. end services reporting period, rub. ; SVs - sales volume of hotel rooms services at the beginning of the reporting period, rub.

Source: Compiled by the authors

The resulting effect of innovation processes is a multidimensional definition (P.N. Zavlina, et al., 2004). The magnitude of this effect, from our point of view, is directly determined by the expected efficiency, manifested from the position of the following approaches:

- production and technology;
- innovation and economic;
- socially oriented (Malysheva, & Shestakov 2012).

The content of the resulting effects of the implementation of innovation processes from the standpoint of these approaches is proposed in Table 2 (Abdukarimov 2013; Galkina 2011; Rumyantseva, Egorova 2015).

**Table 2.** Content of the resulting effects of the implementation of innovative processes in hotel organizations

<b>Indicators of the production and technological result of the implementation of innovative processes (REPT)</b>
The proportion of new IT
Production automation ratio
The proportion of innovative technological processes
Tourist flow
Revenue per 1 room-night
Average annual load factor
Duration of stay for 1 room
Profit per 1 number
Profitability of hotel services
Revenue per number
The average income per guest
<b>Indicators of the innovative economic result of the implementation of innovative processes (REI)</b>
Capital investment on the implementation of innovative processes
Net present value of innovation processes
Return on innovation processes
Index of profitability of innovation processes
<b>Indicators of socially-oriented net effect of the implementation of innovative processes (RESH)</b>
Increase in revenue of the organization
Profit per employee
Profitability of labor resources
Environmental and workplace safety

Source: Compiled by the authors



#### 4. Results analysis

To study the interaction of elements of innovative activity of hotel organizations with the resulting effects from the implementation of innovative processes, the technology of stochastic factor analysis was chosen.

The use of factor analysis, in particular, methods for studying the dimension of selected groups of factors and the matrix structure of their covariance and correlation, allows you to study comprehensively and measure how the value of the resulting indicators for the implementation of innovative processes depends on the impact factors and to determine linear statistical correlations of correlation and to identify the factors causing their presence (Sheremet 2011).

The choice of a stochastic (correlation) factor analysis based on a graphical and set-theoretic description by structuring innovative activity factors and indicators of the net effect of implementing innovation processes as a methodological approach is due to the multidimensionality and variability of these factors and indicators, as well as their interconnectedness and interdependence. However, the nature of their relationship is incomplete and probabilistic, and for a number of indicators there is a lack of full amount of quantitative information, which makes it necessary to use qualitative analysis to establish qualitative (causal) relationships between them (Abdukarimov, Narizhnyj 2014). The structuring process ends with the construction of a stochastic factor model.

The analysis procedure involves combining the most correlated among themselves factors of innovation activity with indicators of resulting effects. At the same time, the level of correlation of one factor with different indicators of the resulting effect can vary considerably. As a result of this procedure, latent variables are determined (Sheremet).

For the mathematical description of the factor model, we construct the correlation matrix corresponding to it and conduct some stages of factor analysis and stochastic modeling.

At the first stage, we proposed to build a stochastic matrix of innovation activity indicators (Table 3).

**Table 3.** Stochastic matrix of EIA indicators

X \ Y	ICp	HEPS	DPS	TPC	IPRC	TPIC	CREC	TRFA	AUR	MANR	HSP	PSR	IGR	IFS	FII	CHSS	REPT	REI	RESH
ICp	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
HEPS	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
DPS	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TPC	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
IPRC	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0
TPIC	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0
CREC	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0
TRFA	0	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	0	1	0
AUR	0	0	0	0	1	0	1	0	0	1	0	0	1	1	1	1	0	1	0
MANR	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	0	1	0
HSP	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	1	1	0	1
PSR	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
IGR	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1	0	1	0

IFS	0	0	0	0	0	1	0	1	1	1	1	0	1	0	1	1	1	1	0
FII	0	0	0	0	0	1	0	1	1	1	1	0	1	1	0	1	1	1	0
CHSS	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	0	1	0	0
REPT	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0
REI	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0
RESH	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0

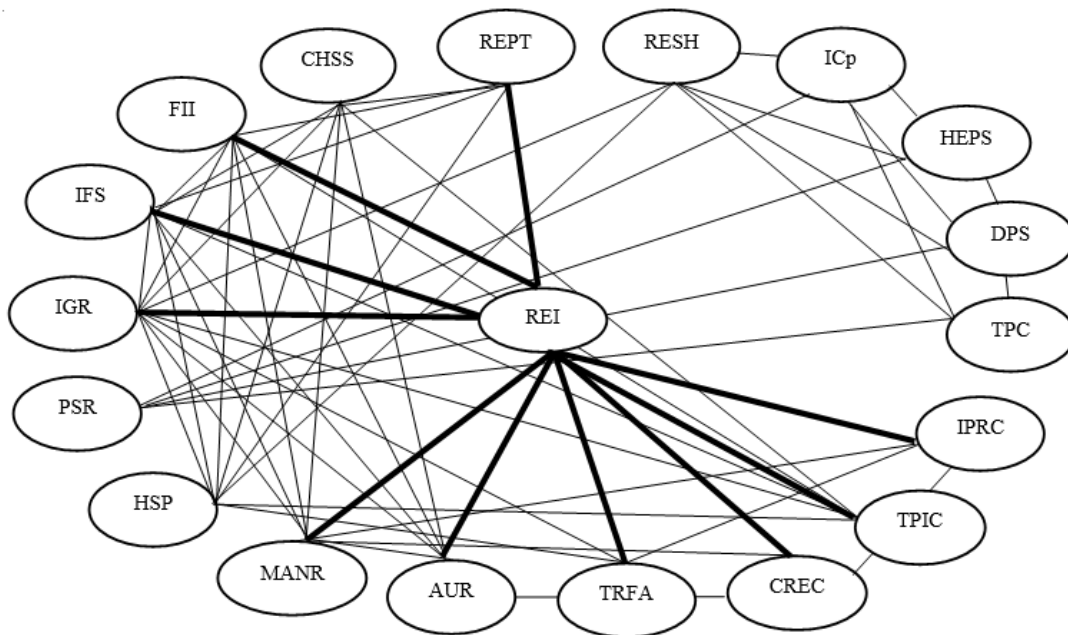
At the next stage, it is proposed to calculate the number of units in each row and column, taking into account the calculation of the dimensions and the ordering of the indicators in descending order (Table 4).

**Table 4.** Ranking of stochastic relations of indicators of EIA of hotel organizations

X	10	9	9	7	7	7	6	5	5	5	4	4	4	4	4	4	4	3	3
	REI	HSP	IFS	TRFA	IGR	FII	CHSS	MANR	TPIC	AUR	RESH	ICp	HEPS	DPS	TPC	PSR	REPT	IPRC	CREC
Y	9	8	8	7	7	7	7	6	5	5	5	4	4	4	4	4	4	3	3
	REI	IFS	FII	AUR	MANR	HSP	IGR	TPIC	CHSS	RESH	ICp	HEPS	DPS	TPC	TRFA	PSR	REPT	IPRC	CREC

A graphical depiction of the established relationships of the selected indicators and the resulting effects is shown in Figure 3.

The analysis shows the multidimensionality of the concept of "innovative activity of hotel organizations", and also allows us to characterize the relationship of its components.



**Figure 3.** A stochastic graph of indicators of EIA and the resulting effects of innovative processes

The prevailing number of links between indicators of the innovation and economic resulting effect of the innovation processes implemented by hotel organizations (REI) allows us to conclude about the most meaningful character of this component, which forms the center of the correlation graph and is a latent variable. This fact leads to the possibility and the need to allocate REI as a higher order variable.

Indicators of the share of financing innovation in the revenue from the sale of hotel services (IFS) and the share of financing of introduced innovations in the total amount of financed innovations (FII) are similar in the number of linear connections and have a high correlation coefficient.

Among the elements of innovation activity, indicators of the intensity of innovation activity have the largest share of correlation. The lowest level of correlation is demonstrated by indicators reflecting the qualitative composition of the organization's personnel.

At the final stage, we will conduct a quantitative assessment of the innovative activity of hotel organizations. The values for all indicator blocks for the ten selected hotel organizations in Sochi are presented in Table 5. The selection of these organizations is based on close categorical affiliation (3–4 stars), a comparable number of rooms and proximity in the location, which allows considering them as competing, and also justifies the possibility of comparing them (Kokurin 2011; Kuznetsova, Rud'2013). The names of the organizations were not disclosed in order to preserve confidential information.

**Table 5.** Indicators of the elements of innovative activity of hotel organizations in Sochi

Indicators EIA		Organization 1	Organization 2	Organization 3	Organization 4	Organization 5	Organization 6	Organization 7	Organization 8	Organization 9	Organization 10
IP	ICp	0,09	0,06	0,09	0,07	0,20	0,08	0,07	0,14	0,06	0,07
	HEPS	0,23	0,13	0,06	0,03	0,15	0,15	0,10	0,14	0,10	0,08
	DPS	0,08	0,07	0,08	0,02	0,10	0,12	0,08	0,05	0,11	0,18
	TPC	0,39	0,28	0,28	0,04	0,05	0,20	0,45	0,16	0,83	0,05
	IPRC	0,11	0,07	0,11	0,11	0,18	0,23	0,17	0,14	0,13	0,06
	TPIC	0,01	0,04	0,02	0,10	0,07	0,06	0,00	0,05	0,06	0,06
	CREC	0,32	0,36	0,65	0,20	0,16	0,11	0,81	0,03	0,27	0,52
IU	TRFA	0,13	0,07	0,13	0,18	0,06	0,08	0,10	0,09	0,16	0,31
	AUR	0,27	0,39	0,28	0,09	0,33	0,64	0,15	0,20	0,40	0,95
	MANR	0,15	0,17	0,15	0,25	0,19	0,07	0,03	0,14	0,23	0,35
	HSP	0,10	0,10	0,16	0,03	0,00	0,08	0,24	0,08	0,10	0,02
	PSR	0,17	0,08	0,15	0,10	0,05	0,19	0,28	0,28	0,33	0,08
II	IGR	0,30	0,11	0,31	0,12	0,64	0,14	0,20	0,11	0,33	0,10
	IFS	0,13	0,15	0,16	0,16	0,27	0,16	0,27	0,03	0,29	0,19
	FII	0,27	0,34	0,37	0,38	0,75	0,04	0,41	0,01	0,07	0,01
	CHSS	0,06	0,10	0,16	0,33	0,15	0,02	0,23	0,23	0,21	0,14

Based on the data of table 5, by correlating the values to the maximum for the period under consideration, the normalized values of the EIA indicators of hotel organizations were calculated (Table 6).

Methodology. For a comprehensive assessment of innovation activity, we suggest using integral indicators, defined as the root of the product of all relevant indicators:

$$\Sigma(IP) = \sqrt[8]{ICp * HEPS * DPS * TPC * IPRC * TPIC * CREC * TRFA}, \quad (1)$$

$$\Sigma(IU) = \sqrt[5]{AUR * MANR * HSP * PSR * IGR}, \quad (2)$$

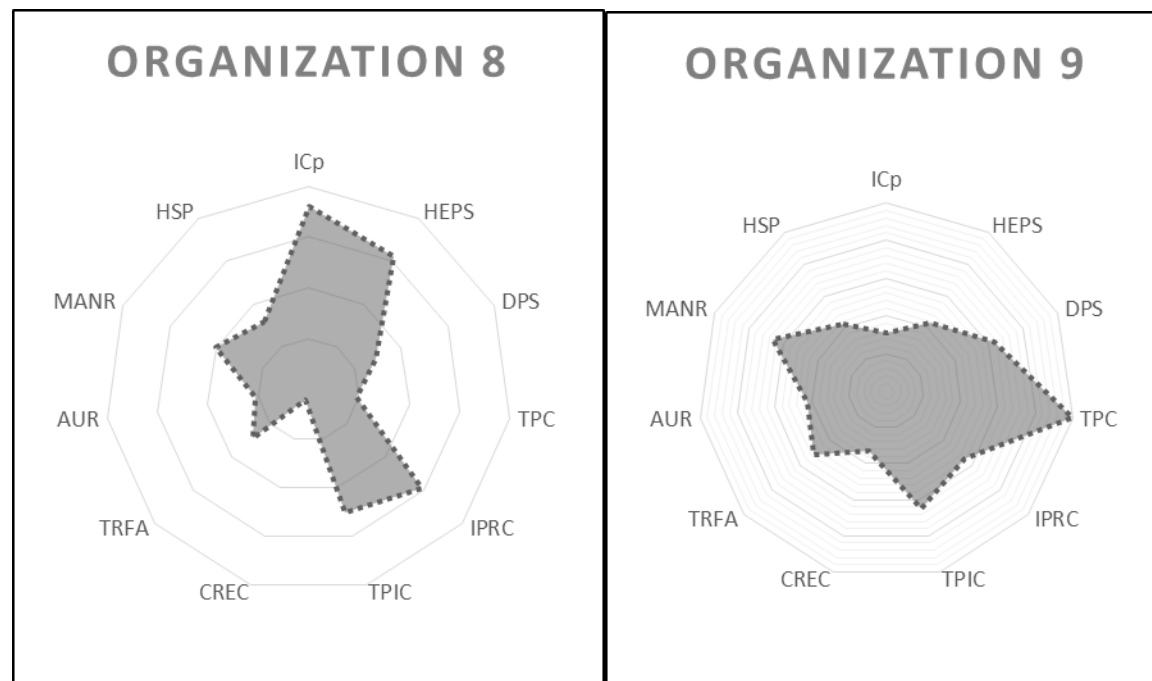
$$\Sigma(II) = \sqrt[3]{IFS * FII * CHSS}, \quad (3)$$

**Table 6.** Normalized values of indicators of EIA of hotel organizations in Sochi with the calculation of integral indicators

Indicators		Organization 1	Organization 2	Organization 3	Organization 4	Organization 5	Organization 6	Organization 7	Organization 8	Organization 9	Organization 10
IP	ICp	0,44	0,31	0,47	0,35	1,00	0,42	0,33	0,72	0,31	0,36
	HEPS	1,00	0,56	0,27	0,12	0,64	0,65	0,41	0,62	0,43	0,33
	DPS	0,44	0,41	0,46	0,12	0,54	0,65	0,45	0,29	0,63	1,00
	TPC	0,47	0,34	0,33	0,05	0,06	0,24	0,54	0,19	1,00	0,06
	IPRC	0,47	0,31	0,45	0,49	0,76	1,00	0,71	0,59	0,55	0,26
	TPIC	0,14	0,42	0,23	1,00	0,73	0,65	0,03	0,50	0,65	0,66
	CREC	0,39	0,44	0,8	0,25	0,20	0,13	1,00	0,04	0,33	0,64
	TRFA	0,43	0,23	0,44	0,58	0,19	0,25	0,32	0,29	0,51	1,00
$\Sigma(IP)$		0,65	0,60	0,64	0,50	0,62	0,64	0,60	0,55	0,72	0,64
IU	AUR	0,29	0,41	0,3	0,09	0,35	0,68	0,16	0,21	0,42	1,00
	MANR	0,44	0,5	0,43	0,73	0,55	0,19	0,09	0,40	0,66	1,00
	HSP	0,44	0,42	0,7	0,11	0,02	0,32	1,00	0,32	0,42	0,09
	PSR	0,52	0,25	0,46	0,29	0,14	0,59	0,84	0,86	1,00	0,25
	IGR	0,47	0,17	0,49	0,19	1,00	0,22	0,31	0,17	0,52	0,15
$\Sigma(IU)$		0,65	0,57	0,68	0,45	0,48	0,59	0,57	0,57	0,75	0,57
II	IFS	0,46	0,52	0,55	0,55	0,96	0,55	0,93	0,10	1,00	0,68
	FII	0,36	0,45	0,5	0,51	1,00	0,06	0,55	0,02	0,09	0,01
	CHSS	0,17	0,31	0,5	1,00	0,46	0,07	0,70	0,71	0,65	0,43
$\Sigma(II)$		0,55	0,65	0,72	0,81	0,87	0,36	0,84	0,32	0,62	0,37
$\Sigma(EIA)$		0,61	0,61	0,68	0,57	0,64	0,51	0,66	0,46	0,69	0,51

As can be seen from Table 6, the highest value of the integral indicator of innovation activity  $\square$  (NUE) is shown by Organization 9 (0.69), the smallest - Organization 8 (0.46).

Based on the obtained values, a petal diagram is constructed, representing the highest and lowest integral levels of innovation activity among the organizations under consideration (Figure 4).



**Figure 4.** Comparison of the smallest and highest level of the integral indicator of innovative activity of hotel organizations in Sochi

According for the previous research, the main role for the After plotting the dependence  $\ln K = f(t)$ , it was hypothesized that the dependence can be represented in the form of a regression equation of the form:  $y = a + bx$ . The adequacy of the model was estimated by the value of the Fisher criterion. Therefore, the developed model is adequate, the program works correctly.

After calculating the reaction rate constants, the dependence  $K = f(t)$  was constructed. When visual assessment of the graphs are observed depending on the experimental and calculated values.

## Conclusion

Summing up the research, we can conclude that the proposed approach to the assessment of innovative activity, based on integral indicators and stochastic factor modeling of the resulting effects, allows to determine key factors and indicators, the development of which will most contribute to the sustainable innovative development of hotel organizations (Krajukhin et al. 2012).

Using this methodological approach allows you to determine the current efficiency of ongoing innovation processes and the prospects of their further development and implementation, to determine the factors of positive and negative impact on the organization's innovation activities, as well as to diagnose the weak points of existing elements of innovation activity in order to optimally manage them.

Of practical interest is a comparison of the integral indicator with similar indicators of the company's main competitors, leaders of innovation development, as well as with an indicator calculated on the basis of statistical data of enterprises of the hospitality industry (Reutov, Prakticheskaja 2015).

## References:

- Abdulkarimov I. T. (2013) Faktory, vlijajushhie na rezul'tativnye pokazateli hoz'jajstvennoj dejatel'nosti predpriyatij, ih klassifikacija i metody ocenki [Factors impacting resulting indicators of enterprise activity, their classification and methods of evaluation]. *Sotsial'no-jeconomicheskie javlenija i processy*. Tambov 12: 9-14.
- Abdulkarimov I. T., Narizhnyj I. F. (2014) Faktornyj analiz ocenki vlijaniya faktorov vnutrennej sredy predpriyatija na rezul'tativnye pokazateli ego hoz'jajstvennoj dejatel'nosti, [Factor analysis of the assessment of the influence of factors of the internal environment of the enterprise on the performance indicators of its economic activity] *Region: sistemy, jekonomika, upravlenie* 3(26): 123-131.
- Akaka, M. A., & Vargo, S. L. (2014). Technology as an operant resource in service (eco) systems. *Information Systems and e-Business Management* 12(3): 367–384.
- Alvesson, M., & Kärreman, D. (2000). Varieties of discourse: On the study of organizations through discourse analysis, *Human Relations* 53(9): 1125–1149.
- Anisimov Ju.P., Peshkova Ju.V., Solnceva E.V. (2006). Metodika ocenki innovacionnoj dejatel'nosti predpriyatija, [Methodology for assessing the innovation activity of an enterprise.] *Innovacii* 11: 88–90.
- Battour, M., & Ismail, M. N. (2016). Halal tourism: Concepts, practices, challenges and future, *Tourism management perspectives* 19: 150-154.
- Beketov N.V. (2008). Innovacionnaja dejatel'nost' i innovacionnyj process: sushhnost' i osnovnye jetapy issledovanija v jekonomicheskoy literature [Innovation activity and the innovation process: the essence and the main stages of research in the economic literature.] *Ekonomicheskij analiz: teorija i praktika* 3: 11–16.
- Bovin, A. A. (2011). Upravlenie innovacijami v organizacii: ucheb. Posobie [Innovation management in the organization: studies. book] / A. A. Bovin, L. E. Cherednikova, V. A. Jakimovich. – M.: Omega-L. 416p.
- Buhalis, D., & Law, R. (2008). Progress in tourism management: 20 years on and 10 years after the internet - the state of e-Tourism research, *Tourism Management* 29(4): 609-623. <https://doi.org/10.1016/j.tourman.2008.01.005>
- Chkalova, O., Efremova, M., Lezhnin, V., Polukhina, A., Sheresheva, M. (2019). Innovative mechanism for local tourism system management: a case study, *Entrepreneurship and Sustainability Issues* 6(4): 2052-2067. [http://doi.org/10.9770/jesi.2019.6.4\(35\)](http://doi.org/10.9770/jesi.2019.6.4(35))
- Dezhkina, I. P. (2012). Innovacionnyj potencial hoz'jajstvennoj sistemy i ego ocenka (metody formirovanija i ocenki) [Innovative potential of the economic system and its assessment (methods of formation and assessment)] / I. P. Dezhkina. – M.: Infra-M, 122 p.
- Fathutdinov, R. A. (2013). Innovacionnyj menedzhment: uchebnik dlja vuzov [Innovation Management: a textbook for universities] / R. A. Fathutdinov. – SPb: Piter, 448 p.
- Galkina, A. N. (2011). Kriterii ocenki jeffektivnosti innovacionnyh processov v organizacii [Criteria for evaluating the effectiveness of innovation processes in organizations], *Ekonomicheskij analiz: teorija i praktika* 43 (250): 10–23.
- Indikatory innovacionnoj dejatel'nosti. [Innovation Indicators] (2012). stat. sb. M.: Nacional'nyj issledovatel'skij universitet «Vysshaja shkola jekonomiki», 472p.
- Kokurin, D. I. (2011). Innovacionnaja dejatel'nost' [Innovative activity] / D. I. Kokurin. – M.: Jekzamen, 576p.
- Krajuhin G.A., Ershov V.F., Frajmovich V.B. (2012). Upravlenie innovacionnym razvitiem predpriyatij i organizacij na osnove izmenenij, [Management of innovative development of enterprises and organizations based on changes] *Vestnik INZhJeKONa* 1: 144–148.
- Kuznecova T.E., Rud' V.A. (2013.) Konkurencija, innovacii i strategija razvitija rossijskikh predpriyatij [Competition, innovation and development strategy of Russian enterprises] (rezul'taty jempiricheskikh issledovanij), *Voprosy jekonomiki*. 12: 86-108.



Malysheva L.A., Shestakov I.V. (2012). Analiz podhodov k ocenke innovacionnoj aktivnosti rossijskikh predpriyatij [Analysis of approaches to the assessment of innovative activity of Russian enterprises] URL: [http://www.sr.pstu.ru/files/VestnikSocialnojeekonomnauki14\\_2012.pdf](http://www.sr.pstu.ru/files/VestnikSocialnojeekonomnauki14_2012.pdf)

Mariev O.S., Savin I.V. (2010). Faktory innovacionnoj aktivnosti rossijskikh regionov: modelirovanie i jempiricheskij analiz. [Factors of innovation activity of the Russian regions: modeling and empirical analysis] *Ekonomika regiona* 3: 235–244.

Medlik, S. (2012). *Dictionary of travel, tourism and hospitality*. Routledge, 679p.

Mohsin, A., Ramli, N., & Alkhulayfi, B. A. (2016). Halal tourism: Emerging opportunities, *Tourism Management Perspectives* 19: 137-143.

Munar, A. M. (2012). Social media strategies and destination management, *Scandinavian Journal of Hospitality and Tourism* 12(2): 101-120. <https://doi.org/10.1080/15022250.2012.679047>

Nikolova, M. S., & Hassan, S. S. (2013). Nation branding effects on retrospective global evaluation of past travel experiences, *Journal of Business Research* 66(6): 752-758.

Osnovy innovacionnogo menedzhmenta. [Fundamentals of innovation management] Teorija i praktikapod red. P. N. Zavlina, A. K. Kazanceva, L. Je. Mindeli. – M.: Ekonomika, 2004. – 518 s.

Panfiluk, E.; Szymańska, E. (2017). The measurement of the innovativeness of health tourism services using an adequacy matrix, *Entrepreneurship and Sustainability Issues* 4(4): 400-420. [http://doi.org/10.9770/jesi.2017.4.4\(1\)](http://doi.org/10.9770/jesi.2017.4.4(1))

Petrenko, Y., Vechkinzova, E., Antonov, V. (2019). Transition from the industrial clusters to the smart specialization of the regions in Kazakhstan, *Insights into Regional Development* 1(2): 118-128. [https://doi.org/10.9770/ird.2019.1.2\(3\)](https://doi.org/10.9770/ird.2019.1.2(3))

Pröbstl-Haider, U., Melzer, V., & Jiricka, A. (2014). Rural tourism opportunities: strategies and requirements for destination leadership in peripheral areas, *Tourism Review* 69(3): 216-228.

Reutov A.Ju. Prakticheskaja 2015. Interpretacija kolichestvennoj ocenki innovacionnoj aktivnosti organizacii [Interpretation of the quantitative assessment of innovative activity of the organization] URL: [http://rus.neicon.ru:8080/xmlui/bitstream/handle/123456789/2627/12\\_352-160.pdf?sequence=1](http://rus.neicon.ru:8080/xmlui/bitstream/handle/123456789/2627/12_352-160.pdf?sequence=1)

Rumjanceva A.V., Egorova I.S. 2015. Pokazatelej dlja ocenki jeffektivnosti funkcionirovanija sub#ektov innovacionnoj sistemy Rossii. [Indicators to assess the performance of the subjects of the innovation system of Russia] URL:<http://vestnik.urfu.ru/archive/statja/Journal/article/44/sistema-pokazatelei-dlja-ocenki-ehffektivnosti-funkcio/>

Ryan, C., & Page, S. (Eds.). (2012). *Tourism Management*. Routledge, 347p.

Sheremet A. D. (2011). *Teorija ekonomicheskogo analiza*. [Theory of Economic Analysis] M.: INFRA-M, 352p.

Shevyakova, A., Munsh, E., Arystan, M. (2019). Information support for the development of tourism for the diversification of the economy of Kazakhstan, *Insights into Regional Development* 1(2): 138-154. [https://doi.org/10.9770/ird.2019.1.2\(5\)](https://doi.org/10.9770/ird.2019.1.2(5))

Tarlow, P. (2007). Dark tourism—the appealing ‘dark’ side of tourism and more. In *Niche tourism* (pp. 61-72). Routledge, 345p.

Vertakova Ju.V., Vaganova O.V. 2012. Vydelenie prioritetov innovacionnogo razvitija regiona na osnove integral'noj ocenki, [Highlighting the priorities of innovative development of the region based on an integrated assessment] *Region: sistemy, jekonomika, upravlenie* 1: 85–89

Ziyadin S., Litvishko O., Dubrova M., Smagulova G., Suyunchaliyeva M. (2019) Diversification tourism in the conditions of the digitalization, *International Journal of Civil Engineering and Technology (IJCIET)* 10(2): 1055-1070 <http://www.iaeme.com/ijciet/issues.asp?JType=IJCIET&VType=10&IType=02>

Ziyadin, S., Kabasheva, N. (2018). The Basis for Initiating the Eurasian Integration of the Agricultural Sector, *Public Administration Issues*. Special Issue (electronic edition), pp. 56–67

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## EFFECTS OF ICT'S ON ENERGY MANAGEMENT SYSTEMS\*

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**Abstract.** The modern world is facing hedge amount of challenges in the area of energy management. Information and Communication technologies are on of most important tools for managing, monitoring and improving the energy consumption efficiency if they are implemented and used for that. Not all countries dealing with this issues successfully and effectively. Therefore scientific and practical solutions based on regions specifics are necessary. This article aims to analyze the peculiarities of Middle East countries in ICT usage in energy management sector. After conducting the researches, it can be stated that the positive influences of the ICTs' in managing the energy management sector are valid, valuable and giving progressive results. The research results are presented further in the article and the peculiarities of the factors and the tools that are used to improve efficiency and sustainability of in the energy management sector in Middle East countries.

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## 1. Literature Review

The energy crisis observed to be one of the major emerging issues due to its rising on demand as well as on reducing supply. The reason behind the energy crisis is the limited availability of oil resources along with the restricted supply due to the geographical barriers along with political conflicts (Williams & Alhajji, 2003; McKillop, 2008; Vegeera et al. 2018). The growing concern of energy crisis is also due to its over-consumption, rising population of the world, poor infrastructure for its efficient & effective management, and unexplored renewable energy options. It also includes a delay in commissioning of power plants and excessive wastage of energy by the consumers in certain regions.

The modern world faced with enormous environmental problems and challenges that no individual, governments, nor companies would want to wish away (Hannan, Al Mamun, Hussain, Basri, & Begum, 2015, Dudin et al. 2019). The energy consumption of the society has created harmful and deep-rooted consequences to the environment that if not tamed, threatens to destroy the ecosystem. Energy consumption, therefore, should be managed efficiently so that it does not cause additional challenges to the already imbalanced environment. The biggest challenge of the current generation, consequently, would be the efficient management of energy consumption systems (Adamczewski, 2016; Rogalev et al. 2018). When the warning was sounded about the possible consequences of depleted energy reservoirs, different governments and stakeholders in the energy sector committed to finding innovative and sustainable ways that could meet the spiraling energy demands (Cullen-Knox, Eccleston, Haward, Lester, & Vince, 2017; Strielkowski 2017; Abbas 2018; Tvaronavičienė 2018; Tvaronavičienė et al. 2018; Masood, et al. 2019). The ICT sector, in its reaction to this proposal, offered to put in place innovative ways that could help end the energy consumption menace and to also open new avenues by designing newer methods that would consume less energy (Trentesaux, Borangiu, & Thomas, 2016). Currently, most companies and governments have realized that the ICT sector could help them to some extent in the management of their energy policies for the future. Therefore, the role that ICT could play in the energy sector management cannot be wished away and, consequently, any individual, company, or government that would want to manage its energy sector efficiently should incorporate the ICT systems available to them. Consequently, the ICT sector has effects that are more beneficial in the energy management sector than the disadvantages of incorporating ICT in energy management systems.

The purpose of this article was to evaluate the factors and the tools that are used in order to improve efficiency and sustainability of in the energy management sector I Middle East countries. For the research literature review and Multi Criteria Decision Analysis in row with descriptive analysis of results were employed.

## 2. Literature Review

One of the major causes of the energy crisis is its increasing demand in the global context. Contextually, the increasing demand has also been due to the rising population throughout the world (Coyle & Simmons, 2014). The underdeveloped nations such as Lebanon face financial issues with reduced cash flow. Hence, this, in turn, affects the supply of supply of energy (Qasim & Kotan, 2013). The growing concern for the environment protection from the use of fossil fuel has resulted in the restriction in its consumption (Festus & Ogoegbunam,

2015). Climate change in the global context has also led to the growing concern for environmental protection (Pathak, 2014). In addition, the poor infrastructure has also been the reason for the global energy crisis, which increases the production cost as well as complexity associated with it (Coyle & Simmons, 2014). Moreover, the wastage of energy has been a common phenomenon in both urban and rural areas, which, in turn, causes its crisis at the time of requirement (Pathak, 2014). In Lebanon, the energy distribution system is poor due to the lack of proper infrastructure. Hence, due to this particular reason, the country faces a crisis in both rural and remote areas (Qasim & Kotan, 2013). During wars, especially evident from World War II, there have been severe international political conflicts, which resulted in an energy crisis in some nations (Coyle & Simmons, 2014). Natural calamities also affect the supply chain process, especially in the case of oil pipeline burst due to which energy cannot be distributed to the destination. The heavy taxes on oil and automobiles causes energy crisis to a certain extent (Coyle & Simmons, 2014).

Energy security and efficiency assurance is highly important for economic growth as well as development along with its sustainability in the long run. It leads to industrial growth, which in, turn, increases employment and the purchasing power of the people. It significantly contributes to reducing the inflation rate as well as poverty among people (Stošić-Mihajlović & Trajković, 2018). Moreover, energy security and efficiency assurance is crucial for saving the planet, as it reduces pollution and carbon footprint along with the lowering of the possibility of climate change (Volyand, Woodman, Hook, Reece, & Fagan, 2010). Energy security along with efficiency assurance leads to the welfare of the society, as it promotes industrialization and establishes modern societies. It also ensures the development of a clean and healthy environment for the people (Bokor, 2013). Besides, energy security and efficiency assurance leads to a reduction in the operational costs of the respective companies (Mechtenberg, 2009).

### **2.1. Combining Environmental Effects and ICT**

To the energy consumers, a reduction in the expenditures they incur in terms of costs would be a welcome idea. On the contrary, businesses and associated companies would look at the idea of cutting energy consumption expenses in a variety of ways (Higón, Gholami, & Shirazi, 2017). For instance, they would be willing to cut on their energy consumption if it would lead to an improvement in their production and rationalization of their procedures. Moreover, they would not consider cutting their energy consumption if the effect would affect the quality of their services, lead to customer dissatisfaction, or lead them into loss-making ventures. Currently, ICT has enabled a reduction in the consumption of energy by gathering and offering services that manage information in simpler ways than before (Kramers, Höjer, Lövehagen, & Wangel, 2014). The development and emergence of devices that are handled, stored, dematerialized, and transmitted like computers, computer programs, and networks have brought a new road to the cutting down of energy consumption.

Information and Communication Technologies that include the internet and GSM transmission have been at the forefront in helping different sectors cut down on their energy consumption (Ahmed, Naeem, & Iqbal, 2017). These inventions came with the advantages such as high speeds of transmitting data, the security of the information that they convey, and their ease of use. These advantages would justify these developments in the ICT sector as beneficial to different companies and individuals alike. People would not use these services if they were complicated, and the security of the information they transmit was questionable. Even though broadband systems provide their clients with a variety of internet-based energy saving options, the internet could not be the only ray that would address energy efficiency. Telecommunications operators also have the advantage of using GPRS in their data management system for companies and individuals that do not have access to the internet.

In the present context, ICT plays a crucial role in all aspects, thereby contributing to the betterment of the life of people (Sharma, Gandhar, Sharma, & Seema, 2011). ICT largely supports in enhancing the knowledge of the people throughout the world regarding various aspects. Thus, people by using this gained knowledge can



contribute to own betterment in several fields (Luić & Glumac, 2009). ICT in the modern day context is mainly used in learning. It involves the presence of various technologies, which can be used for learning. Apart from the improved learning scope from the use of ICT, it also plays a role in enhancing problem-solving and decision-making skills. Thus, ICT can be used for effective problem solving along with decision making of the various issues related to people. This also implies the issue energy crisis can be solved as well as effective decisions can be taken for the energy security and efficiency assurance (Sharma, Gandhar, Sharma, & Seema, 2011).

The role of ICT in using Emerging Learning Technologies (ELT) such as blogs, podcast, and wikis among others supports in enhancing one's knowledge (Sharma, Gandhar, Sharma, & Seema, 2011). The role of ICT in improving business practices through improved communication and coordination with all the stakeholders. Additionally, it supports in the effective decision making and problem solving of the business by successfully using and analyzing the available information (Luić & Glumac, 2009). The online buying and selling of goods and the conducting electronic business activities have been feasible through the development of ICT. This helps in enhancing the business efficiency along with reducing cost. Thus, it offers similar scope to the energy producing and dealing companies to lower the cost and enhance efficiency (Luić & Glumac, 2009). Moreover, ICT plays the role of conducting e-governance, which, in turn, ensures the effective implementation of the policies. Thus, the government can effectively implement energy security and efficiency assurance policies (Luić & Glumac, 2009).

## **2.2 Application of Energy Management Systems**

The best way to manage energy would be the control and reduction of energy consumption by all the economic players of the world. Application of an efficient and effective energy management system would be the appropriate way to reduce and control this (Houghton, Miller, & Foth, 2014). Energy management systems could be used to help in the analysis and maximization of consumption rates. These systems would help in controlling equipment that consumes energy, follow up on real-time consumption, and in data recovery of any faults that may have been detected in the energy consumption trends of any given individual or company. The ICT sector has enabled the development and installation of these management systems that have been of benefit to several consumers around the globe (Klimova et al., 2016). Companies and individuals have had the benefit of monitoring and managing their energy consumption and have the added advantage of controlling their consumption through the use of these systems. Even though these systems could be easily found in offices, there have been other management systems that also enable people in residential places to control energy consumption, for example, in lighting and heating devices (Zhou & Yang, 2016). Although improvements can be made to the energy management systems to make them better, the length that the ICT sector has gone to make energy management simpler and easy cannot be underrated. The development of such systems has enabled most businesses to cut or control their energy expenses. Such cuts and controls on energy consumption have the net effect of reducing the emission of greenhouse gases to the environment and also improving the efficient management of energy systems thanks to ICT based automation.

## **3. Research Methodology**

The above-mentioned background information motivated in conducting research to identify and assess the way ICT can be used in energy security as well as efficiency. In this regard, the rationale behind conducting this research has been to identify and evaluate the positive effects of implementing ICT for reducing the technical problems, lowering the cost, maintaining energy management security, and assuring efficiency. Further motivation has been gained from the fact that this study attempted to determine and evaluate the ways through which the energy problems in the underprivileged nations can be mitigated.

A research was conducted with experts in the energy management field from Lebanon, United Arab Emirates and Jordan. The aim of the research was to evaluate the factors and the tools that are used to improve efficiency and

sustainability of in the energy management sector. Using the Multi Criteria Decision Analysis (MCDA), the tools and the factors were evaluated and a descriptive analysis explaining the results were discussed.

**Table 1.** Demographic data of the experts

Demographics	Percentage
<b>Location of Experts</b>	
Lebanon	33%
UAE	50%
Jordan	17%
<b>Gender of the Experts</b>	
Male	67%
Female	33%
<b>Age of Experts</b>	
Between 36-50	50%
Between 51-65	50%
<b>Educational degree of Experts</b>	
Masters degree	83%
PHD	17%

Data was collected from six experts in the field of energy management during spring 2019. Demographic characteristics of experts are presented in table 1. Cronbach Alpha to test for internal consistency was used, results are presented in table 2. Cronbach Alpha for the four criteria and three indicators was analyzed. Cronbach alpha is used to measure internal consistency and when cronbach alpha possesses a value greater than 0.8 then the internal consistency is excellent and items within each factors are closely related and are well combined as a group. As for the criteria; tools and external factors had an excellent consistency while systems and processes had a good consistency. As for the indicators; management and productivity had an excellent consistency while efficiency had a good consistency.

**Table 2.** Cronbach Alpha to test for internal consistency

Indicators	Internal consistency
Criteria 1: ICT tools in energy management sector	0.81
Criteria 2: Management systems in ICT	0.78
Criteria 3: Management processes in ICT	0.76
Criteria 4: External factors in ICT	0.83
Indicator 1: Management	0.87
Indicator 2: Efficiency	0.70
Indicator 3: Productivity	0.82

#### 4. Discussion and results

The third world countries (like some countries in Middle East) have been facing major issues of an energy crisis due to a lack of effective infrastructure along with insufficient fund. However, this issue can be resolved by the application of ICT. The use of ICT in the third world countries would facilitate in gaining along with assessing information, which, in turn, contribute to conducting innovation in the energy sector. This, in turn, leads to an increased generation of energy as well as its efficient distribution throughout the nation. The wastage of energy has been a common issue in the underdeveloped, which can be addressed by the implementation of ICT. In addition, ICT involves tracking of the energy performance and identifying, wherein there is wastage of energy. The immediate addressing of the issue leads to the cost saving of the energy sector. This is extremely crucial from

the perspective of a third world nation. The use of ICT in the energy sector in the third world nations leads to the improvement of the infrastructure, which has been the major issue prevailing in these countries. The infrastructural development contributes to the increased energy. In the third world nations, ICT can also be used to aware people regarding the importance of saving energy and the ways it can be conducted by consumers.

Descriptive statistics of the four criteria's of ICT in energy management sector is conducted and frequency and percentages are reported in the table 3. Results showed that the six experts are in either medium or high agreement with all the indicators of the four criteria. Experts were asked to rate each criteria and their sub-categories on a scale of 1 to 10. Due to conformity of experts to the above indicators; rating of below 7 were considered to be low agreement, rating of 7 and 8 were considered medium agreement and rating of 9 and 10 were considered to be in high agreement.

**Table 3.** Descriptive statistics of the four criteria's of ICT in energy management sector

Variable	Medium	High
<b>Criteria 1: ICT tools in energy management sector</b>		
Efficiency of using laptops in energy management sector for data management and technical reporting	33%	67%
Availability of smart devices in the hand of the users in energy management sector for energy usage and billing	67%	33%
Usage of online applications in energy management sector for energy usage and billing	67%	33%
Availability of website for people to report technical or human errors happening in energy management sector	17%	83%
Availability of computer hardware for Information and communication technology solutions in energy management sector	67%	33%
Coverage of internet to report technical problems on the spot in energy management sector	17%	83%
<b>Criteria 2: Management systems in ICT</b>		
Importance of information systems in energy generating activities	17%	83%
Importance of information systems in energy storage activities	67%	33%
Importance of information systems in hiring qualified people	83%	17%
Importance of information systems in evaluating the human resources	50%	50%
Importance of information systems in cloud storage management	67%	33%
Importance of information systems in collecting fees online	50%	50%
Importance of information systems in reporting on technical problems	33%	67%
<b>Criteria 3: Management processes in ICT</b>		
Importance of current processes used in the energy management sector in decision making	83%	17%
Impact of current systems used in the energy management sector in strategies	33%	67%
Influence of problem solving strategies used in the energy management on processes	33%	67%
Influence of project planning used in the energy management on strategies	33%	67%
Influence of project controlling used in the energy management on strategies	-	100%
Influence of impact analysis used in the energy management on strategies	33%	67%
<b>Criteria 4: External factors in ICT</b>		
Importance of infrastructure on upgrading the energy management sector	67%	33%
Importance of government policies on energy management sector	33%	67%
Acceptance of people on implementing new systems in the energy management sector	17%	83%
Importance of natural resources on implementation within the energy management sector	-	100%
Importance of human resources on implementation within the energy management sector	17%	83%
Importance of technological resources on implementation within the energy management sector	-	100%
Importance of governmental regulations in the development of the energy management sector	33%	67%
Effect of economy in development within the energy management sector	17%	83%
Availability of the infrastructure in the implementation of new technologies within the energy management sector	67%	33%

The three indicators that ICT have effect on in the energy management sector is conducted and frequency and percentages are reported in the table 4. Results showed that the six experts are in either medium or high agreement with all the indicators that ICT have effect on in the energy management sector. Experts were asked to rate indicator on a scale of 1 to 10. Due to conformity of experts to the above indicators; rating of below 7 were considered to be low agreement, rating of 7 and 8 were considered medium agreement and rating of 9 and 10 were considered to be in high agreement.

**Table 4.** Descriptive statistics of the three indicators that ICT have effect on in the energy management sector

Variable	Medium	High
<b>Indicator 1: Management</b>		
Importance of operations in implementing ICT in energy management sector	33%	67%
Importance of cost reduction in energy management sector	17%	83%
Importance of improvements in energy management sector to the public	33%	67%
Importance of natural resources availability in energy management sector	33%	67%
Importance of human resources in energy management sector	50%	50%
Importance of time management in energy management sector	83%	17%
Importance of property management in energy management sector	33%	67%
<b>Indicator 2: Efficiency</b>		
Importance of action plan in applying ICT in energy management sector	50%	50%
Importance of sustainability in applying ICT in energy management sector	17%	83%
Importance of growth rate in applying ICT in energy management sector	33%	67%
Importance of performance in applying ICT in energy management sector	67%	33%
Importance of measurements in applying ICT in energy management sector	17%	83%
Importance of energy resources in applying ICT in energy management sector	67%	33%
<b>Indicator 3: Productivity</b>		
Importance of framework in upgrading the energy management sector	17%	83%
Importance of quality in energy management sector	33%	67%
Importance of waste reduction in energy management sector	33%	67%
Importance of productivity in decreasing the cost in energy management sector	50%	50%
Importance of safety in energy management sector	33%	67%
Importance of assessment tools in energy management sector	33%	67%

Average of the four criteria of the ICT was assessed. Experts were asked to rate in general the importance of ICT tools in the energy management sector, importance of management systems in ICT, importance of processes in ICT and importance of external factors in ICT. The results are presented in rtable 5. 33% agreed that tools are important while 67% considered the tools as extremely important as one of the ICT in the energy management sector. As for the management of systems in ICT; 50% rated the management system as important and 50% rated it as extremely important. 67% rated the importance of management processes in ICT as very important and 33% rated it as important. Half of the experts agreed that external factors in ICT are important and the rest considered it as very important element.

**Table 5.** Average of the four criteria's of ICT in energy management sector

Variable	Medium	High
1: ICT tools in energy management sector	33%	67%
2: Management systems in ICT	50%	50%
3: Management processes in ICT	33%	67%
4: External factors in ICT	50%	50%

In order to prioritize the criteria and sub-criteria, six experts were consulted. Questionnaire was developed by following the methodology proposed by AHP. Tools, systems, processes and external factors sub-criteria were assessed with respect to the four criteria of the ICT. Each expert was given the same weight, thus the process of aggregation of all the judgments was performed using the geometric mean. The comparison matrix of the four criteria is represented in table 6.

The implementation of ICT largely impacts and benefits with respect to energy management security and efficiency assurance. It significantly supports in reducing the technical issues in the energy management. In this context, it can be analyzed that ICT supports in improved communication between the stakeholders of energy producing companies. This, in turn, assists in addressing the quality issues. It further supports in conducting research as well as witnessing innovation for increasing the energy efficiency.

**Table 6.** Pairwise comparison of the criteria

Criteria	Tools	System	Processes	External factors
<b>Tools</b>	1	1.958	1.125	0.638
<b>System</b>	0.8839	1	0.811	1.543
<b>Processes</b>	0.7985	0.8140	1	0.957
<b>External factors</b>	0.8844	0.9140	0.8073	1

The use of ICT in the energy sector has also led to the reduction of the cost of energy management security and efficiency assurance. This has been apparent from the fact that ICT significantly contributes to the energy sector by increasing productivity as well as rationalizing the process. This, in turn, directly contributes to the reduction of the operational cost of the company. However, ICT further ensures that the reduction of cost does not affect the quality of the product or service, customer satisfaction, and revenue collection.

The use of ICT is also helpful in finding new sources of energy through extensive research and employment of varied related technologies. Thus, it can help in overcoming the global challenges related to the energy crisis. It can also be evaluated that ICT can be effectively utilized for improving the infrastructure for efficient production, management, and distribution of energy all over the world. The energy sector has also been facing the issue of excessive wastage, which, in turn, causes the crisis to a certain extent. In this regard, the use of ICT is extensively effective, as it leads to the identification of the areas, which generates wastage.

## Conclusion

Based on the overall discussion, it is apparent that ICT significantly contribute to energy security as well as efficiency assurance. It supports in overcoming the technical issues in energy management along with, maintaining efficient, and effective energy supply and reduction of the cost. It mainly involves the use of cloud and internet technology, radio frequency, GPRS, various software, and hardware along with the computerized processing of several related information. Thus, it largely helps the underdeveloped countries in mitigating the issue of the energy crisis. The improved communication through the integration of ICT assists in immediately addressing the supply chain issues of the energy sector. It also assists in reducing wastages, thereby contributing towards reducing the involved costs along with the greater maintenance of higher efficiency and energy security. ICT also supports in conducting of innovation that supports in the identification of new efficient energy at reduced cost. Moreover, ICT assists in improving the infrastructure in the energy supply process. This, in turn, ensures that energy is available at all places in the region. The integration of ICT also helps in promoting the use of renewable energy throughout the world. It ensures the protection of the environment along with the maintenance of people's health, as it involves reduced carbon emission.

This paper examined the effects that the ICT sector has on the energy management systems and the possible positive impacts that ICT played in the reduction of energy consumption; thereby reducing the emission of gases into the atmosphere. It has been established that the initially feared effects of an explosively growing ICT industry have not been seen in effect, but rather the ICT industry has had more benefit in the energy management systems than its disadvantages. At the same time, the ICT sector continues to grow as well as the energy consumption, however, the role of controlling, monitoring and developing the energy sector will have a positive effect on the energy consumption.

## References

- Abbas, S. A. (2018). Entrepreneurship and Information Technology Businesses in Economic Crisis, *Entrepreneurship and Sustainability Issues* 5(3): 682-692. [https://doi.org/10.9770/jesi.2018.5.3\(20\)](https://doi.org/10.9770/jesi.2018.5.3(20))
- Adamczewski, P. (2016). ICT solutions in intelligent organizations as challenges in a knowledge economy, *Management* 20(2): 198-209.
- Ahmed, F., Naeem, M., & Iqbal, M. (2017). ICT and renewable energy: a way forward to the next generation telecom base stations, *Telecommunication Systems* 64(1): 43-56. <https://doi.org/10.1007/s11235-016-0156-4>
- Aslan, J., Mayers, K., Koomey, J. G., & France, C. (2018). Electricity intensity of Internet data transmission: Untangling the estimates, *Journal of Industrial Ecology* 22(4): 785-798. <https://doi.org/10.1111/jiec.12630>
- Auvinen, H., & Tuominen, A. (2014). Future transport systems: long-term visions and socio-technical transitions, *European Transport Research Review* 6(3): 343-354. <https://doi.org/10.1007/s12544-014-0135-3>
- Belkhir, L., & Elmeligi, A. (2018). Assessing ICT global emissions footprint: Trends to 2040 & recommendations, *Journal of Cleaner Production* 177: 448-463. <https://doi.org/10.1016/j.jclepro.2017.12.239>
- Bieser, J. C., & Hilty, L. M. (2018, May). Indirect Effects of the Digital Transformation on Environmental Sustainability: Methodological Challenges in Assessing the Greenhouse Gas Abatement Potential of ICT. In ICT4S (pp. 68-81).
- Bokor, L. (2013). The energy resources and their importance in the local environment, *Locality* 1(1): 14-19.
- Botta, A., De Donato, W., Persico, V., & Pescapé, A. (2014, August). On the integration of cloud computing and internet of things. In 2014 International Conference on Future Internet of Things and Cloud (pp. 23-30). IEEE. <https://doi.org/10.1109/FiCloud.2014.14>
- Boru, D., Kliazovich, D., Granelli, F., Bouvry, P., & Zomaya, A. Y. (2015). Energy-efficient data replication in cloud computing data centers, *Cluster computing* 18(1): 385-402. [https://doi.org/978-1-4799-2851-4/13/\\$31.00](https://doi.org/978-1-4799-2851-4/13/$31.00)
- Chen, Y., Ardila-Gomez, A., & Frame, G. (2016). Achieving energy savings by intelligent transportation systems investments in the context of smart cities. World Bank. <https://doi.org/10.1016/j.trd.2017.06.008>
- Cohen-Blankshtain, G., & Rotem-Mindali, O. (2016). Key research themes on ICT and sustainable urban mobility, *International Journal of Sustainable Transportation* 10(1): 9-17. <https://doi.org/10.1080/15568318.2013.820994>
- Coyle, E. D. & Simmons, R. A. (2014). Understanding the global energy crisis. Purdue University Press, 1-282.
- Cullen-Knox, C., Eccleston, R., Haward, M., Lester, E., & Vince, J. (2017). Contemporary Challenges in Environmental Governance: Technology, governance and the social license, *Environmental Policy and Governance* 27(1): 3-13. <https://doi.org/10.1002/eet.1743>



- Dudin, M.N.; Frolova, E.E.; Protopopova, O.V.; Andrey Alievich Mamedov, A.A.; Odintsov, S.V. (2019). Study of innovative technologies in the energy industry: nontraditional and renewable energy sources, *Entrepreneurship and Sustainability Issues* 6(4): 1704-1713. [http://doi.org/10.9770/jesi.2019.6.4\(11\)](http://doi.org/10.9770/jesi.2019.6.4(11))
- Erol-Kantarci, M., & Mouftah, H. T. (2014). Energy-efficient information and communication infrastructures in the smart grid: A survey on interactions and open issues, *IEEE Communications Surveys & Tutorials* 17(1): 179-197. <http://doi.org/10.1109/COMST.2014.2341600>
- Festus, M. O. & Ogoegbunam, O. B. (2015). Energy crisis and its effects on national development: The need for environmental education in Nigeria, *British Journal of Education* 3(1): 21-37.
- Gelenbe, E., & Caseau, Y. (2015). The impact of information technology on energy consumption and carbon emissions, *Ubiquity*, 2015 (June), 1.
- Hannan, M. A., Al Mamun, M. A., Hussain, A., Basri, H., & Begum, R. A. (2015). A review on technologies and their usage in solid waste monitoring and management systems: Issues and challenges, *Waste Management* 43: 509-523. <http://doi.org/10.1016/j.wasman.2015.05.033>
- Higón, D. A., Gholami, R., & Shirazi, F. (2017). ICT and environmental sustainability: A global perspective, *Telematics and Informatics* 34(4): 85-95. <http://doi.org/10.1016/j.tele.2017.01.001>
- Hilty, L. M., & Aebischer, B. (Eds.). (2015). ICT innovations for sustainability (Vol. 310). Springer. <http://doi.org/10.1007/978-3-319-09228-7>
- Hintemann, R. (2015). Consolidation, colocation, virtualization, and cloud computing: the impact of the changing structure of data centers on total electricity demand. In ICT Innovations for Sustainability (pp. 125-136). Springer, Cham.
- Houghton, K., Miller, E., & Foth, M. (2014). Integrating ICT into the planning process: impacts, opportunities, and challenges, *Australian Planner* 51(1): 24-33. <https://doi.org/10.1080/07293682.2013.770771>
- Huda, M., Maseleno, A., Atmotiyoso, P., Siregar, M., Ahmad, R., Jasmi, K., & Muhamad, N. (2018). Big data emerging technology: insights into innovative environment for online learning resources, *International Journal of Emerging Technologies in Learning (iJET)* 13(1): 23-36.
- Inacio, E. C., & Dantas, M. A. (2014). A survey into performance and energy efficiency in HPC, cloud and big data environments, *International Journal of Networking and Virtual Organisations* 14(4): 299-318.
- Kant, G., Quak, H., Peeters, R., & van Woensel, T. (2016). Urban freight transportation: challenges, failures, and successes. In Logistics and supply chain innovation (pp. 127-139). Springer, Cham.
- Klein, T. E., & Richard, P. (2016, March). ICT energy challenges, impact, and solutions. In 19th International ICIN Conference-Innovations in Clouds, Internet, and Networks.
- Klimova, A., Rondeau, E., Andersson, K., Porras, J., Rybin, A., & Zaslavsky, A. (2016). An international Master's program in green ICT as a contribution to sustainable development, *Journal of Cleaner Production* 135: 223-239. <http://doi.org/10.1016/j.jclepro.2016.06.032>
- Kramers, A., Höjer, M., Lövehagen, N., & Wangel, J. (2014). Smart sustainable cities–Exploring ICT solutions for reduced energy use in cities, *Environmental modeling & software* 56: 52-62. <http://doi.org/10.1016/j.envsoft.2013.12.019>
- Laitner, J. A. S. (2015). The energy efficiency benefits and the economic imperative of ICT-enabled systems. *ICT Innovations for Sustainability* (pp. 37-48). Springer, Cham. [http://doi.org/10.1007/978-3-319-09228-7\\_2](http://doi.org/10.1007/978-3-319-09228-7_2)
- Malmodin, J., & Bergmark, P. (2015, September). Exploring the effect of ICT solutions on GHG emissions in 2030, *EnviroInfo and ICT for Sustainability* 2015. Atlantis Press. <https://doi.org/10.1016/j.ict4s-env-15.2015.5>

- Masood, O.; Tvaronavičienė, M.; Javaria, K. 2019. Impact of oil prices on stock return: evidence from G7 countries, *Insights into Regional Development* 1(2): 129-137. [https://doi.org/10.9770/ird.2019.1.2\(4\)](https://doi.org/10.9770/ird.2019.1.2(4))
- McKillop, A. (2008). The final energy crisis. London: Pluto Press.
- Mechtenberg, A. R. (2009). Understanding the importance of an energy crisis. Abigail Reid Mechtenberg, 1-43.
- Nica, E. (2015). ICT innovation, internet sustainability, and economic development, *Journal of Self-Governance and Management Economics* 3(3): 24-29.
- Qasim, M. & Kotani, K. (2013). Causes of energy shortage in Pakistan: An empirical evidence, *Economics & Management Series*, 1-25.
- Olaverri-Monreal, C. (2016). Autonomous vehicles and smart mobility related technologies, *Infocommunications Journal* 8(2): 17-24.
- Pazowski, P. (2015). Green computing: latest practices and technologies for ICT sustainability. In Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society, Joint International Conference, Bari, Italy (pp. 1853-1860).
- Pathak, S. (2014). Energy crisis: A review, *Journal of Engineering Research and Applications* 4(3), 845-851.
- Rogalev, A.; Komarov, I.; Kindra, V.; Zlyvk, O. (2018). Entrepreneurial assessment of sustainable development technologies for power energy sector, *Entrepreneurship and Sustainability Issues* 6(1): 429-445. [http://doi.org/10.9770/jesi.2018.6.1\(26\)](http://doi.org/10.9770/jesi.2018.6.1(26))
- Scuotto, V., Ferraris, A., & Bresciani, S. (2016). Internet of Things: Applications and challenges in smart cities: a case study of IBM smart city projects, *Business Process Management Journal* 22(2): 357-367. <https://doi.org/10.1108/BPMJ-05-2015-0074>
- Shyshkina, M. P., Zaporozhchenko, Y. G., & Kravtsov, H. M. (2014). Prospects of the development of the modern educational institutions' learning and research environment: To the 15th anniversary of the institute of information technologies and learning tools of naps of Ukraine.
- Stošić-Mihajlović, L. & Trajković, S. (2018). The importance of energy for the economy, sustainable development and environmental protection: An economic aspect, *Journal of Process Management. New Technologies* 6(1): 20-26. <http://doi.org/10.5937/jouproman6-16221>
- Strielkowski, W., Lisin, E., Astachova, E. (2017). Economic sustainability of energy systems and prices in the EU. *Entrepreneurship and Sustainability Issues* 4(4): 591-600. [http://dx.doi.org/10.9770/jesi.2017.4.4\(14\)](http://dx.doi.org/10.9770/jesi.2017.4.4(14))
- Suryawanshi, K., & Narkhede, S. (2014). Green ICT at higher education institution: Solution for sustenance of ICT in future, *International Journal of Computer Applications* 107(14): 35-38. <http://doi.org/10.5120/18823-0237>
- Trentesaux, D., Borangiu, T., & Thomas, A. (2016). Emerging ICT concepts for smart, safe and sustainable industrial systems, *Computers in Industry*, Elsevier 81: 1-10. <http://doi.org/10.1016/j.compind.2016.05.001>
- Tvaronavičienė, M. 2018. Towards sustainable and secure development: energy efficiency peculiarities in transport sector, *Journal of Security and Sustainability Issues* 7(4): 719-725. [https://doi.org/10.9770/jssi.2018.7.4\(9\)](https://doi.org/10.9770/jssi.2018.7.4(9))
- Tvaronavičienė, M., Prakapienė, D., Garškaitė-Milvydienė, K., Prakapas, R., Nawrot, Ł. (2018). Energy Efficiency in the Long-Run in the Selected European Countries, *Economics and Sociology* 11(1): 245-254. <https://doi.org/10.14254/2071-789X.2018/11-1/16>
- Van Heddeghem, W., Lambert, S., Lannoo, B., Colle, D., Pickavet, M., & Demeester, P. (2014). Trends in worldwide ICT electricity consumption from 2007 to 2012, *Computer Communications* 50: 64-76. <http://doi.org/10.1016/j.comcom.2014.02.008>

Vermesan, O., & Friess, P. (Eds.). (2014). Internet of things-from research and innovation to market deployment (Vol. 29). Aalborg: River Publishers.

Wang, Y., Sanchez Rodrigues, V., & Evans, L. (2015). The use of ICT in road freight transport for CO2 reduction—an exploratory study of UK's grocery retail industry, *The International Journal of Logistics Management* 26(1): 2-29. <https://doi.org/10.1108/IJLM-02-2013-0021>

Whitehead, B., Andrews, D., Shah, A., & Maidment, G. (2014). Assessing the environmental impact of data centers part 1: Background, energy use, and metrics, *Building and Environment* 82: 151-159. <http://doi.org/10.1016/j.buildenv.2014.08.021>

Williams, J. L., & Alhajji, A. F. (2003). The coming energy crisis, *Oil and Gas Journal* 101(5): 1-13.

Vegera, S.; Malei, A.; Sapeha, I.; Sushko, V. (2018). Information support of the circular economy: the objects of accounting at recycling technological cycle stages of industrial waste, *Entrepreneurship and Sustainability Issues* 6(1): 190-210. [http://doi.org/10.9770/jesi.2018.6.1\(13\)](http://doi.org/10.9770/jesi.2018.6.1(13))

Volyand, F., Woodman, P., Hook, C., Reece, M., & Fagan, J. M. (2010). The importance of energy conservation: Raising awareness in today's youth. EPA Energy Conservation, 1-5.

Wu, J., Zhang, Y., Zukerman, M., & Yung, E. K. N. (2015). Energy-efficient base-stations sleep-mode techniques in green cellular networks: A survey, *IEEE communications surveys & tutorials* 17(2): 803-826. <http://doi.org/10.1109/COMST.2015.2403395>

Zhang, C., & Liu, C. (2015). The impact of ICT industry on CO2 emissions: a regional analysis in China, *Renewable and Sustainable Energy Reviews* 44: 12-19. <http://doi.org/10.1016/j.rser.2014.12.011>

Zhou, K., & Yang, S. (2016). Understanding household energy consumption behavior: The contribution of energy big data analytics, *Renewable and Sustainable Energy Reviews* 56: 810-819. <http://doi.org/10.1016/j.rser.2015.12.001>

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## CROSS-BORDER TOURISM COOPERATION AS A BASIS FOR SUSTAINABLE DEVELOPMENT: A CASE STUDY

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**Abstract.** The article presents critical review of approaches to understanding cross-border tourism cooperation. The authors substantiate peculiarities of tourism development in the mountain region, revealing the possible influence of tourism on the border regions, which can be both positive and negative. The paper examines five types of cross-border tourist structures using the example of the Altai-Sayan mountain region. Those types determine the direction and potential of cross-border tourism cooperation. The authors consider the possibilities of organizing the development of various types of tourism in the border area. Tourism can contribute to the sustainable development of a mountainous transboundary region.

**Keywords:** cross-border region, mountain region, tourism, fields of cooperation, the Altai-Sayan Mountains

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**JEL Classifications:** F20, F23

**Additional disciplines** ecology and environment; geography

### 1. Introduction

Cross-border tourist interaction is of particular interest in the regional issues of mountainous areas. Cross-border cooperation started developing in Europe back in the 1950<sup>th</sup>. Its main objectives were associated with the abolition of barriers, dividing the communities of the border areas of various European countries. Cross-border cooperation contributes to mitigation of the negative effects of state borders and the periphery of border areas, improving the socio-economic situation of the local population. To identify the prerequisites promoting tourist cooperation it is important to study the cross-border region.

Cross-border systems are characterized by the integrity and mutual influence of two or several autonomous links located on opposite sides of the borders, the intersection of the geopolitical interests of the neighboring states, the asynchrony and asymmetry of changes on opposite sides of the border (Artemenko 2010). Mountain regions very often become the place of contact for not only state borders. They are characterized by high fragmentation of ethnic groups, peculiar socio-economic development and the variety of tourist resources. Problems of cross-border cooperation imply the solution of various issues: socio-economic, ethnic and ethnocultural interaction, regionalization and interconnection, reduction of threats to economic and national security, etc. Several economic, political, historical, and social prerequisites provide incentives for the development of cross-border cooperation.

There are different approaches to the study of cross-border regionalism, which are also related to the study of models of rational economic activity, ethnocultural interaction, tourism, etc. Most studies focus on comparative analysis of the border areas. Study of the cross-border region is one of the approaches, in which a cross-border region is considered as a space of exceptional civilizational, political, economic and cultural interaction. A cross-border region can be examined through the socio-economic potential of the border areas, their geopolitical significance and individual features of the border. The border areas, where socio-ethnic and economic similarity predetermines the development of cooperation, are of particular interest (Baggio 2008). Identification of cross-border systems and regions provides a guiding framework for the study of cross-border tourist areas.

In accordance with J. House model, various relations influence the situation in the border regions: between the states; between the border region and its capital; interstate relations between adjacent border areas; relations between border areas within each country (Druzhinin 2010).

The development of cross-border regions is of great importance for improving efficiency and regional proportions of the economy. Cross-border cooperation is the most natural function of border areas and one of the main factors contributing to their development (Zigern-Korn, Sevast'yanov 2009; Tvaronavičienė, 2017; Mikhaylov et al. 2018). Border areas define the formation of cross-border ties, which form the basis of cross-border regionalism. It is a spatially integrated form of political cooperation in addressing problems that can be jointly solved by the border regions. Development of cross-border regionalism is a consequence of inter-connectedness and the limited ability of individual states and international organizations to address certain global issues.

Globalization is the most important factor in the development of cross-border territories, which is the dominant factor and method of the territorial organization of society. The spatial integration-disintegration process of specific border areas is increasing (Gerasimenko 2005; Kiselitsa et al. 2018).

## **2. Case study of Altai-Sayan mountain region**

The natural historical background of cross-border cooperation in the mountain region is associated with peculiarities of the natural conditions of the territory, which influence the formation of culture and traditions of economic activities in the region.

The authors have identified the opportunities for cross-border tourist cooperation in the Altai-Sayan mountain region, which is located in the central part of Eurasia, the center of Eurasia, within the borders of four states. In the Russian part, the region completely occupies the territories of the republics of Altai, Tyva, Khakassia and partly Altai and Krasnoyarsk Territories, Kemerovo, Novosibirsk and Irkutsk Regions and the south-western part of the Republic of Buryatia. The foreign part of the region includes the eastern districts of the East Kazakhstan region; Altai administrative district of Xinjiang Uygur Autonomous Region; twelve aimaks of Mongolia. Currently, cross-border tourist relations gradually develop in the region and it is possible to define the potential for their further development (Dunets et al. 2019).



However, the most famous example of cross-border interaction of the states, located in the mountain region, is the activities of the countries located in the Alpine region. The Alpine Convention, signed in 1991 by Austria, Germany, Italy, Liechtenstein, Monaco, Slovenia, France and the EU was the first international document, consolidating efforts for sustainable development of this mountain region. It is aimed at the integration of the economic interests of the local population and the creation of the principles of cross-border cooperation between the Alpine countries. To achieve these goals, appropriate measures are being developed in twelve sectors: demography and culture, spatial planning, nature protection and rural areas, mountain farming, tourism, etc. (Dunets 2011).

Development of cross-border regional cooperation in the Russian Federation became possible due to the implementation of the principles of federalism and power decentralization. This cooperation has its own distinctive features in each part of the country. Cross-border communication covers all major fields of vital activity of the regions. Trade and economic ties play a key role in regional cooperation since they are the easiest to adjust between the internal and adjacent parts of different countries. However, in addition to the benefits of cross-border interaction, there may be dangerous trends. Those are associated with a violation of trade, the predominance of imports, and sale of raw materials at low prices.

The impact of tourism on the economy of a cross-border region is manifested in the development of trade and economic relations (receiving income from the provision of services, shopping tourism, purchase of goods and souvenirs by tourists). The interaction of tourism with the socio-economic complex of a cross-border region is a complex system. Such interaction cannot be measured using only statistical data (Aleksandrova 2009). The implementation of the border areas institutions functions goes in several directions:

- economic interaction, determined by the action of rules and regulations for border crossing by tourists, baggage transportation (including purchased goods, hunting and fishing equipment, guidebooks and maps, etc.);
- social and cultural interaction involves various options for tourist contacts with the local population of the border areas, the establishment of cultural relations, participation in national and cultural holidays, awareness of cultural objects and organizations;
- ecological interaction is aimed at the promotion of biodiversity conservation, development of ecotourism, contributing to the maintenance of activities of specially protected natural areas.

Tourism in the cross-border region has a direct and indirect economic influence on the cooperation of the border areas, which may be both positive and negative (table 1).

**Table 1.** Possible impact of cross-border tourism cooperation

Objects of influence of the border area	Positive influence	Negative influence
Economy	Infrastructural development, income generation in regional budgets, small and medium business development, etc.	Currency leakage and construction of infrastructure facilities in the territory of a neighboring state, increased competition
Culture	Development of traditional culture, etc.	Commercialization of culture, disrespect for cultural values, etc.
Social sphere	Improvement of the living conditions, employment, provision of goods and services, development of the social sphere, etc.	The increase in crime, the migration of the working population to a neighboring country, the growth of imports and the reduction in consumption of domestic goods and services, etc.
Ecology	Joint protection of natural areas, biodiversity conservation, transboundary protected areas, etc.	Excessive loads on certain natural complexes, transboundary pollution, etc.
Management	Agreements on international cooperation and their implementation, etc.	The increasing complexity of planning and regulation of the development of industries, fiscal, border and customs problems, etc.

*Source:* author

The "geographical transboundary structures" are of particular importance for international cooperation (Gerasimenko 2005; Artemenko 2010). The authors have identified various types of cross-border tourist structures, which determine the potential of cross-border tourist cooperation in the Altai-Sayan mountain region:

1. Natural-resource structures of a linear or areal type. These are geographic systems intersecting the state borders, aqua and territorial combinations of natural resources for the development of which cross-border cooperation is advisable. In the tourist development of several mountain peaks and ridges, international cooperation is advisable. Most state borders between the countries in the mountain region run along with the axial parts of the mountain ranges. Some lakes are located in two states (Ubsu-Nur, Tore-Khol, etc.). The Irtysh River, the river basin of which is located on the territory of all four states, is of significant tourist importance. The Selenga River begins in Mongolia and crosses the Russian border). The border between China and Kazakhstan goes along the Ak-Kaba River.

2. Ethnocultural cross-border structures arise when the state border divides a single ethnic group. This contributes to travelling and more comfortable stay in the places of residence of the same ethnic group. In the Altai-Sayan mountain region, Kazakhs also live in the border areas of Russia, China, and Mongolia. East Kazakhstan region has a large percentage of Russians in the population structure. Tuvans live on the territory of Russia, Mongolia and China. There are close ethnocultural ties between the border regions of Buryatia and Mongolia.

3. Economic territorial and economic structures crossed by the state border. For example, the following transport corridors: P-256 "Chuiskii trakt", the main road in the Russian part of the mountain region, continues in Mongolia and then leads to China. Tourist enterprises in the regions have close production and economic ties to carry out cross-border tourist routes.

4. Transboundary specially protected natural territories can function successfully through the development of cooperation in biodiversity conservation and the development of eco-tourism. Such activities are performed, for example, on the territories of the Ubsunur Hollow (Russia) and Uvs-Nur (Mongolia) reserves, which include the ecosystems of the lake of the same name, which are UNESCO World Heritage sites and attract tourists from different countries. The national parks "Tunkinskaya hollow" and "Lake Hovsgol" are border parks and important tourist attractions. Several tourist routes include both parks. In 2011, the official intergovernmental agreement was signed on the creation of a transboundary reserve "Altai" on the basis of the Katunsky Biosphere Reserve (Russia) and the Katon-Karagay National Park (Kazakhstan). The length of the common border is 105 km, and the total area amounts to 795.2 thousand hectares. In the high mountain zone, at the junction of the borders of Russia, China, Kazakhstan and Mongolia, specially protected natural territories adjoin. In the future, they can get the status of an international transboundary UNESCO World Heritage Site.

5. Geopolitical cross-border structures arise between the bordering administrative entities in the interaction in various fields (economic, humanitarian, political). In 1998, the Altai-Sayan working group prepared, discussed and signed the Altai-Sayan Agreement. The Altai Convention was signed in the city of Urumqi (China). This document declares the possibilities of cross-border cooperation in nature protection and tourism development. A necessary condition for the successful development of cross-border regional cooperation is its institutionalization. For this purpose, it is important to create regional organizations that would direct this process, complementing the relevant world institutions (Shinkovsky 2004). In 2003, an international coordination council of the ISS, "Our Common Home Altai" was established, uniting the executive authorities of the Republic of Altai and the Altai Territory (Russia), East Kazakhstan Region (Kazakhstan), Xinjiang Uygur Autonomous Region (China), Khovd, and Bayan -Uylgi aimaks of Mongolia. The council activities are designed to coordinate the cross-border activities of the regions in the field of nature conservation, nature management and tourism development. The Great Altai tourism and sports festival is important for exploring the tourist potential. However, to date, rare meetings of representatives of the regional authorities have little effect on the development of cross-border cooperation. The development of cross-border tourism should be considered in conjunction with the preservation of nature and cultural and historical heritage, the development of transport infrastructure and the expansion of

trade and economic relations (Dunets, Zhogova 2018; (Razminienė, Tvaronavičienė 2017; Razminienė, Tvaronavičienė 2018; Monni et al. 2017; Tvaronavičienė, Razminienė 2017; Zemlickiene et al. 2017; Ohotina et al. 2018; Petrenko et al. 2019). In 2018, it was decided to hold an economic council aimed at the development of trade and economic cooperation and tourism. However, the lack of specific agreements on tourist projects and a very small number of border crossings remain the main obstacle to cross-border tourist cooperation. This hinders cooperation between the representatives of the tourist business in the countries of the mountain region.

The state border may be the object of special touristic interest, and the border area may serve as a tourist destination. The identification of cross-border tourism structures contributes to the identification of cross-border cooperation forms. The use of border areas (located in the immediate vicinity of the border strip) as tourist destinations in the Altai-Sayan mountain region is based mainly on the following types of tourism:

- mountaineering, mountain and hiking tourism (development of mountain ranges and peaks of Tabyn-Bogd-Ola, Munku-Sardyk, Sailyugem, Belukha);
- water and health tourism (lakes Ubsu-Nur, Tore-Khol, rivers Selenga and Irtysh);
- cultural and historical tourism (routes to the places of historical battles, familiarity with the culture of the population living near the border);
- ecological tourism (routes in protected natural territories and their buffer zones, national parks TavanBogd, Kanas, Katon-Karagaysky, Tunkinsky, etc.);
- shopping tours, business tourism; short-term trips to the border area with the purpose of acquiring goods, business meetings, contracts signing;
- educational and scientific tourism (students and schoolchildren visit neighboring states, numerous expeditions work in the region).

Short-term tourist and excursion routes to the neighboring countries are of great importance for the development of cross-border tourism.

For the Altai-Sayan region, we have identified a number of strategic priorities for policy and planning of cross-border tourism cooperation, which can contribute to the sustainable development of this mountain region:

1. Recognition of tourist development of the leading type of organization of the territory in the mountain region.
2. The desire to achieve a balance of social, economic and environmental processes of development of tourist complexes.
3. Development of interregional and cross-border cooperation for the creation of cross-border tourism products, improving the competitiveness of the mountain region in the global tourism market and the implementation of long-term planning.
4. Determination of the structure of tourist complexes and analysis of inter-sectoral interaction, as well as the impact of tourism on the socio-cultural sphere and the environment.
5. The desire to match the tourist complexes with the functional and territorial structure of the natural and cultural-historical potential of the mountain region.
6. Providing professional manageability and responsible marketing of tourist complexes.
7. Understanding of tourism as a subsystem closely interconnected with the geosystem of the mountain region, and ensuring its harmony with the needs of the local population and natural landscapes.

Tourism activity directly forms the incomes of organizations and budgets of different levels, contributes to the development of infrastructure in the border areas, consumer market of goods and services, improving the living standards of the local population. In its turn, tourism in cross-border regions is also influenced by various factors, one of which is administrative-political. The state uses legislative measures to influence tourism (certification, customs, passport and monetary policy). In some cases, state influence inhibits the development of border tourist regions. Various problems related to tourist formalities, transport infrastructure, socio-cultural rejection, low level of economic development and its imbalance, the lack of investment, natural features (high mountain ranges that create natural barriers), and weak regional authorities can negatively influence the tourism development. Those

also include the existing threats to the economic and national security of the state, difficult sanitary and epidemiological situation, political and armed conflicts, large migration flows, etc.).

Cross-border tourism is of great national importance. Visiting the frontier territories of another state facilitates the study of traditions and peculiarities of economy, which develops under similar environmental conditions. It is important for economic integration, for optimizing relations between states and border areas. The absence of cross-border tourist exchange determines the more stringent barrier functions of the state border, creating myths that distort the real situation and relations in the cross-border region.

Business and educational tourism contributes to the development of communications and is an important motivation for the formation of cross-border cooperation. Holding meetings, seminars, conferences with the participation of heads of border authorities, exchange visits by scientists, teachers, schoolchildren, students, cultural and sports events are necessary forms of cross-border cooperation.

Tourist cross-border interaction is advisable to consider in conjunction with the problems of identity and self-identity of social groups living in the border areas. The development of tourism in the cross-border region contributes to the emergence of new problems (challenges) for the socio-cultural sphere (Indicators of Sustainable Development for Tourism Destinations, 2004; Zeibote et al. 2019). In tourist areas, which are mostly visited by tourists, there are changes in local personality and values; commercialization of local culture, standardization of tourist services and tourist facilities; adaptation to the needs of tourists. Tourist development of a cross-border area can lead to sociocultural conflicts. Those are associated with the economic disparity between the locals and the tourists. Due to carelessness and ignorance, some tourists do not respect local customs and local moral values. There may be irritations caused by the tourists' behavior, which harm the natural environment, cultural heritage, etc.

Social prerequisites play a special role in transboundary cooperation. Similarities in language and traditional culture will contribute to increasing interest in the development of economy, culture, tourism, and preservation of biodiversity. Improving the social efficiency of cross-border cooperation is becoming one of the urgent problems of regional development. In connection with the possible multidirectional impact of tourism on cross-border cooperation, management and the formation of a single cross-border region, it is required to provide for planning and regulation at the municipal, regional and national levels.

Further development of tourism in the cross-border Altai-Sayan mountain region is associated with the introduction of a simplified border crossing for tourists, creation of conditions for visiting tourists in the border area, reconstruction and development of border crossings, formation of information and tourist centers and cultural and tourist areas; development of a network of tourist facilities; organization of cross-border routes and their coordination with foreign partners, etc.

The organization of the cross-border region structure is associated with the implementation of specific tourist projects that are implemented based on the principles of sustainable development of tourism and interstate cooperation. These projects include ecotourism development of protected areas, cross-border routes, tourist infrastructure, special Internet sites (for example, the Altai Transboundary website <http://www.altaiinter.info/>)

Development of international tourist routes is important. In recent years, tourist exchange between Russia and Kazakhstan has increased. Such cross-border routes as "Golden Ring of Altai", "Snow Leopard Path", "Baikal-Hubsugul", "Tea Path" and others are being developed. The cross-border route "On the Paths of Genghis Khan" has been developed by the employees of the Baikal Institute for Nature Management of the SB RAS. It provides for traveling within two countries and one Selenga river basin, from its source to the mouth (Baklanov, Tulokhonov 2010). The coupled tourist development of border areas leads to "blurring" of the borders for the tourists and an increase in interaction effects in the cultural, social, economic and environmental areas.

## Conclusions

Cross-border tourism cooperation plays an important role in the process of state integration in the Altai-Sayan mountain region. However, this cooperation is hindered by problems associated with differences between states and border areas: political, economic, infrastructural, socio-demographic, urban planning, administrative law, socio-psychological, ethno-confessional, etc.

The authors revealed the possible influence of cross-border tourist cooperation on the border regions. Planning is required to increase the positive impact and reduce the negative effects.

Undoubtedly, the organization of cross-border tourist cooperation in the mountain region has several particular characteristics. The mechanism for the development of cross-border tourist cooperation and the development of tourist resources in the border areas of the Altai-Sayan mountain region has not yet been developed. Therefore, the most important scientific problem is related to the preparation of recommendations regarding the development of tourism in a mountain cross-border area. Such work has already brought the first results in connection with the activities of the Council "Our Common Home - Altai".

Border mountain regions of different countries compete in attracting tourists. However, their cooperation is possible to make the most of the tourist potential in the cross-border region. Therefore, the cooperation of the tourism organizations and government bodies of these territories will permit to get serious competitive advantages compared to other regions that are more distant from the border.

Five types of cross-border tourist structures formed in the Altai-Sayan mountain region. They determine the direction and potential of cross-border tourism cooperation.

The state border in the Altai-Sayan mountain region may be attractive to tourists. This is due to the possibility of organizing mountaineering, mountain-walking tourism, water and health tourism on rivers and lakes, cultural and historical tourism, ecological tourism in the border area. The greatest economic effect is associated with the development of shopping tourism and business tourism.

In the coming years, in order to develop cross-border tourism, it is necessary to settle the issues of organizational and legal nature, the organization of border crossings by various types of transport, visa regime, etc. This will contribute to the strengthening of the role of the Altai-Sayan mountain region in global tourism development. The intercontinental position of the region causes the intersection of interests, among which tourism has a great humanitarian significance.

## References

Aleksandrova, A. Yu. (2009). The role and influence of the border, border and transboundary in the development of tourism. Sustainable development of tourism: strategic initiatives and partnerships: materials of the international. Scientific practical conference. Ulan-Ude: Publishing house BNTS SB RAS, p. 56-66.

Altai Transboundary website <http://www.altaiinter.info>

Artemenko, S.V. (2010). Geographical study of cross-border regionalism. The theory of socio-economic geography: current state and development prospects. Rostov-on-Don: SFU Publishing House, p. 373-375.

Baggio, R. (2008). Symptoms of complexity in a tourism system, *Tourism Analysis* 13: 1-20.

Baklanov P. Ya., Tulokhonov A. K. (2010). Border and cross-border territories of Asian Russia and neighboring countries (problems and prerequisites for sustainable development). Novosibirsk: Publishing House of the Siberian Branch of the Russian Academy of Sciences. - 610 p.



- Druzhinin, A. G. (2010). Globalization as a factor of innovation in the theory and methodology of socio-economic geography. The theory of socio-economic geography: current state and development prospects. Rostov-on-Don: SFU Publishing House. p. 36- 42.
- Dunets, A.N. (2011). Tourist and recreational complexes of the mountain region: (monograph). Barnaul: Publishing house AltGTU. - 204 p.
- Dunets, A.N., Zhogova, I.G. (2018). Significant Changes of Tourism Industry in the Altai-Sayan Mountainous Region, *Journal of Environmental Management and Tourism* 4 (28). p. 869-879.
- Dunets, A.N., Zhogova, I.G., Sycheva, I.N. (2019). Common characteristics in the organization of tourist space within mountainous regions: Altai-Sayan region (Russia), *Geojournal of Tourism and Geosites* 24(1): 161-174.
- Gerasimenko, T. I. (2005). Problems of the ethnocultural development of transboundary regions. SPb. - 235 p.
- Indicators of Sustainable Development for Tourism Destinations A Guidebook. World Tourism Organization, 2004. – 515 p.
- Kiselitsa, E.P., Shilova, N.N., Liman, I.A., Naumenko, E.E. 2018. Impact of spatial development on sustainable entrepreneurship, *Entrepreneurship and Sustainability Issues* 6(2): 890-911. [http://doi.org/10.9770/jesi.2018.6.2\(28\)](http://doi.org/10.9770/jesi.2018.6.2(28))
- Mikhaylov, A.S., Mikhaylova A.A., Savchina, O.V. (2018). Innovation security of cross-border innovative milieus, *Entrepreneurship and Sustainability Issues* 6(2): 754-766. [http://doi.org/10.9770/jesi.2018.6.2\(19\)](http://doi.org/10.9770/jesi.2018.6.2(19))
- Monni, S., Palumbo, F., Tvaronavičienė, M. 2017. Cluster performance: an attempt to evaluate the Lithuanian case, *Entrepreneurship and Sustainability Issues* 5(1): 43-57. [http://doi.org/10.9770/jesi.2017.5.1\(4\)](http://doi.org/10.9770/jesi.2017.5.1(4))
- Ohotina, A., Lavrinenko, O., Gladevich, J., Lazdans, D. 2018. The investment climate in Latvia's, Lithuania's and Belarus's cross-border regions: the subjective-objective assessment, *Entrepreneurship and Sustainability Issues* 6(2): 767-780. [http://doi.org/10.9770/jesi.2018.6.2\(20\)](http://doi.org/10.9770/jesi.2018.6.2(20))
- Petrenko, Y., Vechkinzova, E., Antonov, V. 2019. Transition from the industrial clusters to the smart specialization of the regions in Kazakhstan, *Insights into Regional Development* 1(2): 118-128. [https://doi.org/10.9770/ird.2019.1.2\(3\)](https://doi.org/10.9770/ird.2019.1.2(3))
- Razminienė, K., Tvaronavičienė, M. 2017. Economic globalization and its impacts on clustering, *Terra Economicus* 15(2): 109-121 [10.23683/2073-6606-2017-15-2-109-121clustering.html](http://dx.doi.org/10.23683/2073-6606-2017-15-2-109-121clustering.html)
- Razminienė, K., Tvaronavičienė, M. 2018. Detecting the linkages between clusters and circular economy, *Terra Economicus* 16(4): 50-65 <https://doi.org/10.23683/2073-6606-2018-16-4-50-65>
- Shinkovsky, M. Yu. (2004). Transboundary cooperation as a lever for the development of the Russian Far East. Policy. № 5. - p. 62-70.
- Tvaronavičienė, M. (2017). Clusters, innovations and energy efficiency: if relationship could be traced, *Marketing and Management of Innovations* 2: 382 - 391 <http://doi.org/10.21272/mmi.2017.2-35>
- Tvaronavičienė, M., Razminienė K. 2017. Towards competitive regional development through clusters: approaches to their performance evaluation, *Journal of Competitiveness* 9(4): 133 – 147. <https://doi.org/10.7441/joc.2017.04.09>
- Zeibote, Z., Volkova, T., Todorov, K. 2019. The impact of globalization on regional development and competitiveness: cases of selected regions, *Insights into Regional Development* 1(1): 33-47. [https://doi.org/10.9770/ird.2019.1.1\(3\)](https://doi.org/10.9770/ird.2019.1.1(3))
- Zemlickiene, V., Mačiulis, A., Tvaronavičienė, M. 2017. Factors impacting the commercial potential of technologies: expert approach, *Technological and Economic Development of Economy* 23(2): 410-427 <http://dx.doi.org/10.3846/20294913.2016.1271061>
- Zigern-Korn, N.V., Sevast'yanov D.V. (2009). Formation of a single recreational space and cross-border cooperation, *Izv. RGO* 141(4): 74-79.



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