

ISSN 2345-0282 ONLINE

DOI: <http://dx.doi.org/10.9770/jesi.2016.4.2>

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

4(2)
2016



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Dear readers,

It is my pleasure to introduce to your attention a new issue of international scientific journal devoted to entrepreneurship and sustainability problems. Today we confront insustainable world. It is obvious that entrepreneurial activities directly affect various areas of our life: to be it global warming processes, energy security, food security or threats to efficient and safe operation in various sectors of economy.

As Ambassador and Director General of Association of Lithuanian Chambers of Commerce, Industry and Crafts, I greet and encourage international discussions that tackle sustainable entrepreneurship and sustainable development of various regions belonging to different countries.

Let us discuss, cooperate, and develop mutual understanding. Let us –science and industry- together devise efficient policies, which would lead us to more prosperous and sustainable future

Best regards,

A handwritten signature in black ink, consisting of stylized, flowing letters that appear to read 'Rimantas Šidlauskas'.

RIMANTAS ŠIDLAUSKAS

*Former Ambassador
Director General
Association of Lithuanian
Chamber of Commerce
Industry and Crafts*



ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

Volume 4

Number 2

December 2016

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

2016
4(2)

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ENTREPRENEURSHIP AND SUSTAINABILITY CENTER

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Editorial correspondence including manuscripts and submissions:

Prof. dr. Manuela Tvaronavičienė

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ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

SERVICE INNOVATION COMMERCIALIZATION FACTORS IN THE FAST FOOD INDUSTRY

Mindaugas Laužikas¹, Aistė Miliūtė², Lukas Tranavičius³, Emilis Kičiatovas⁴

¹ Vilnius University Business School, Saulėtekio Av. 22, LT-10225 Vilnius, Lithuania

¹ Global Innovation Learning Ecosystem (GILE) Experts, Corradino Industrial Estate, Paola, Malta

² AKVAVITA, Neravų st. 100, Viečiūnai, Druskininkai

² Vilnius University Business School, Saulėtekio Av. 22, LT-10225 Vilnius, Lithuania

^{3, 4} Vilnius University Business School, Saulėtekio Av. 22, LT-10225 Vilnius, Lithuania

E-mails: ¹ mindaugas.lauzikas@gmail.com; ² aiste_miliute@yahoo.com; ³ lukas.tranavicius@gmail.com;

⁴ emilis.kiciatovas@gmail.com

Received 19 May 2016; accepted 20 August 2016

Abstract. The purpose of this paper is to examine the service innovation commercialization process in fast food companies. The literature on main concepts of innovation, classification of types of innovation and its processes is well established. However, particularities and unique trends of various economies and industries in terms of innovations call for research efforts to characterize the innovation situation in specific countries and/or industries. In addition to the regional specificity of innovation, Von Stamm (2008), Giannopoulou et al. (2014), Johannessen (2013), Hertog et al. (2010), and Oke (2007) call for discussions on peculiarities of service innovations and its commercialization specificity. The present paper focuses on the commercialization process of service innovation, while choosing as a research object innovations in the fast food industry and emphasizing the case of Lithuania. This research is relevant and innovative as not a little research has been conducted in the field of fast food restaurants. Also, many service innovation opportunities remain underutilized in the fast food industry; thus, the research question ‘What service innovations have the potential to maximize added-value in the fast food market and what is the best way to do this?’ is formulated. We attempt to identify factors that influence a company’s success in the fast food market while analysing the case of Lithuanian fast food companies. Taking into consideration that commercialization demands a thorough expertise in managing resources, strategic planning as well as managing processes from ideas generation to delivering services to the market and/or receiving commercial value from it, the present research is centred on qualitative expert interviews among fast food companies. It serves as the theoretical conceptual framework of service innovation commercialization, and might be followed by similar research on the commercialization of service innovations.

Keywords: service innovation, commercialization, fast food industry, added-value, innovation processes.

Reference to this paper should be made as follows: Lauzikas, M.; Miliūtė, A.; Tranavicius, L.; Kiciatovas, E. 2016. Service Innovation Commercialization Factors in the Fast Food Industry, *Entrepreneurship and Sustainability Issues* 4(2): 108-128.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(1\)](http://dx.doi.org/10.9770/jesi.2016.4.2(1))

JEL classification: M130.

1. Introduction

The service sector is becoming an increasingly important part of any economy, which is contributing to a greater level of growth in terms of economic activity (De Brentani, 2001; Lankauskienė, Tvaronavičienė, 2013; Dudzevičiūtė et al. 2013; Travkina, Tvaronavičienė et al. 2013; Tvaronavičienė, Černevičiūtė 2015). The service sector consists of a wide range of activities, such as transport, government, education, health care, social and personal services, retail and wholesale, hotels and restaurants, telecommunication and financial sector (which includes banks, building societies, insurance and other companies providing financial services). The growing service sector leads to the need of innovative services. Although there is little attention paid to and knowledge obtained concerning innovation in service sectors and/ or development of new services (Drejer, 2004; Adams, 2006; Nijssen, 2006; Spohrer, 2008), service innovation is perceived as a significant driver of growth in companies (Griffin, 1997; Agarwal, 2003). Table 1 summarises different definitions and perspectives on service innovations.

Table 1. Definitions of service innovation

Authors	Definitions of service innovation
John and Storey (1998).	Service innovation is the predominantly intangible core attributes purchased by a customer.
Oslo Manual (OECD, 1997).	Service innovation is defined as a type of product innovation involving the introduction of a service that is new or significantly improved with respect to its characteristics or its intended uses.
Miller <i>et al.</i> (2007), Lyons <i>et al.</i> (2007), Cainelli <i>et al.</i> (2004), van der Aa and Elfring (2002).	Innovation in services is crucial as it allows sustaining of competitive advantages, diminishes the threat of commoditization, and helps service companies outperform their peers, creates opportunities to increase the quality and efficiency of the delivery process and supports the introduction of new service concepts.
Coombs and Miles (2000), van Ark <i>et al.</i> (2003) Gallouj (2002), OECD (2005), the European Commission (2009).	Service innovations are ubiquitous and their role in creating economic growth and wellbeing is increasingly acknowledged.
Johannessen (2013)	Service innovations are tangible or intangible services/ products involving a customer in the design and production process of a product, or in changes in service experience.
Gadrey <i>et al.</i> (1995)	Service innovations are innovations in processes and innovations in organization for existing service products. Service innovations can, therefore, be described as new developments in activities undertaken to deliver core service products for various reasons, e.g. to make those core service products more attractive to consumers.
Pim den Hertog, Wietze van der Aa and Mark W. de Jong (2010).	Service innovation is a new service experience or service solution that consists of one or several of the following dimensions: new service concept, new customer interaction, new value system/business partners, new revenue model, new organizational or technological service delivery system.

Source: Prepared by paper authors, based on Von Stamm (2008), Giannopoulou et al. (2014), Johannessen (2013), Hertog et al. (2010), and Oke (2007).

2. Service innovation classification

To fully understand the particularities of service innovations it is necessary to analyse various scholars' insights and arguments towards service innovation. To begin with, three types of service innovation are identified by Jung-Kuei Hsieh et al. (2013) who carried out research on a practical perspective of classifying service innovations. These are: new service concepts, new service processes and new service business models. The first acknowledges the possibility of whether integrated or diversified service concepts, as well as improvements for existing services. New service processes include extensions for the client interface, innovations for the service delivery system and

improvements for the supply chain. The last concept (new service business models) suggests a new service revenue model, the value network cooperation and a new market segment.

Terrill and Middlebrooks (1996) proposed five distinctive angles to service innovations: positioning innovation, process innovation, service offering innovation, people innovation and communication innovation. The first angle suggests positioning innovation that allows differentiating service or company itself from existing rivals (i.e. a restaurant can introduce a unique service). Secondly, process innovation allows improving customers' experience by removing or adding a particular process step. The third angle, service offering innovation, can occur differently. For example it can be a creation of unique benefits by reorganizing existing offerings, or the addition of new benefits to an existing service, or a totally new service offering. The fourth, human resource innovation is a concept described as discretion of individuals to improve a customer service experience. The last but not least, communications innovation refers to branding of a service offering or a unique communication approach to differentiate service offering.

Furthermore, DeJong and Vermeulen (2003) present the highly recognized New Service Development (NSD) concept in order to group different ideas of research made so far. They form a more ingenious perception about service innovations. Regarding the NSD concept, service innovations are segmented into four different approaches: technologist (Bryson and Monnoyer, 2004), assimilation, demarcation and synthesis (Coombs and Miles, 2000; Drejer, 2004; DeVries, 2006). The technologist approach is based on Barra's (1990) reverse product cycle model for services. The cycle starts with process innovation and leads to the creation of new services (Linton and Walsh, 2008). The approach is based only on a technological competence, ignoring differentiation between other types of services (Salter and Tether, 2006). However, such limitation raises doubts surrounding the reliability of the approach, since many service innovations tend to be non-technological like a new restaurant idea or a new form of insurance (Gallouj, 2002).

The assimilation approach is often linked with technologist perspective (DeVries, 2006), and described as the concept developed in the product sector and easily transferred to service innovation (Coombs and Miles, 2000; Drejer, 2004; DeVries, 2006; Nijssen et al. 2006). However, researchers do not rely on this approach, because it is too limited concerning technology and cannot properly describe innovations in services (Drejer, 2004). The demarcation perspective defines service innovation as distinctive and the difficulty in transferring knowledge from product sector to services. According to this approach, services are described as intangible, co-productive with customers, simultaneous, heterogeneous and perishable (Fitzsimmons, 2000), what makes them unique to a certain level (Nijssen et al., 2006). The last approach is the synthesis which, in contrast to demarcation, focuses on bringing service and manufacturing together (Gallouj and Weinstein, 1997; Coombs and Miles, 2000; Nightingdale, 2003; Drejer, 2004; Howells, 2006; Nijssen et al., 2006), and offers integrative innovation for both service and product sectors (Gallouj and Weinstein, 1997). Although researchers agree on four approaches when defining service innovation, (technologist, assimilation, demarcation and synthesis), synthesis innovation is the most recognized and relevant perspective (Gallouj and Weinstein, 1997; Coombs and Miles, 2000; Drejer, 2004; Miles, 2006; Salter and Tether, 2006; Froehle and Roth, 2007).

Continuing with the synthesis approach, Gallouj and Weinstein (1997) have presented the theory which treats service and product innovations inseparably. It states that service innovations are found in for distinct elements:

- Service outcome characteristics (i.e. new ingredient in a meal, new design of restaurant interior),
- Service provider competencies (i.e. new knowledge and new skills),
- Service provider technology (i.e. new informational technologies, new machines, new methods and procedures),
- Client competences (i.e. client provides on stock-level to supplier).

The model also introduces six different types of service innovations that are radical, incremental, improvement, combinatory or architectural, formalization and ad hoc innovations. The majority are based on previously defined competence-enhancing and competence-destroying types of innovation of Schumpeter's et al. theory. In addition, Gallouj and Weinstein (1997) added a distinctively new type of innovation in service sector – ad hoc innovation, which is defined as interactive and social solution to a particular problem, outlined by a client (DeVries, 2006). The need of ad hoc innovation arises after a customer request. It is a non-repeatable and not formalized as a standard type of service innovation, contradicting Schumpeter's theory. Moreover, after research and successful implementation, it is held as a valid type of innovation (Drejer, 2004; DeVries, 2006).

Another perspective for categorizing service innovations is the four-dimensional service innovation model, suggested by Den Hertog (2000). He offers the approach, based on service and process interaction, arguing that services cannot be innovated focusing on a final result only, since it involves changes in different parts of services in organization. Den Hertog (2000) suggests four dimensions where innovation can be implemented: new service concept dimension, new client interface dimension, new service delivery system dimension, and technological options dimension.

Recently, a different approach to service innovation was introduced by Jing Hua Li (2012) who carried out research on service innovation in China. He presented a cross framework where he distinguished four branches of service innovation regarding different internal and external factors influencing the distinction of innovation types (see Figure 1).

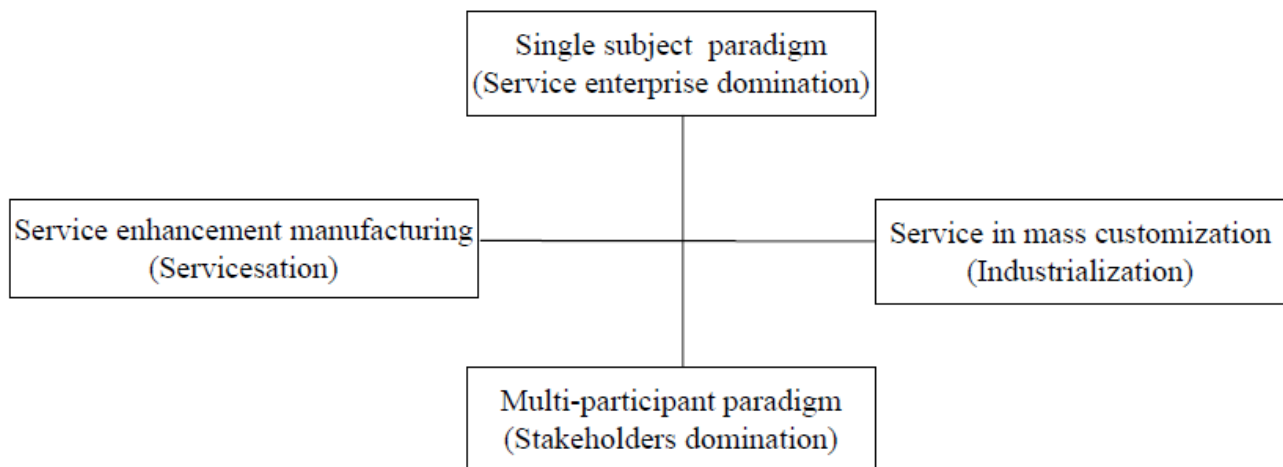


Figure 1. Roadmap of service innovation.

Source: Hua Li, J. (2012). Service innovation research in China: past, present and future. *Journal of Science and Technology Policy in China*. Vol. 3, No. 1, pp. 68-91.

The first branch is a single subject paradigm which defines service innovation as service enterprise dominated focus on organizational issues. Research provides many examples where service innovation might occur in the organization. Pavitt (1984) presents four different patterns: supplier-dominated, specialized suppliers, science-based and information intensive. The organizational mode of service innovation can also be divided into patterns: industrialization, professional co-operation, management (Barcet et al., 1987), entrepreneur and handcraft patterns (Gallouj and Weinstein, 1997). Finally, Tidd and Hull (2003) divided service innovation into four types: craft-batch – has the best service delivery, mechanistic bureaucracy – the lowest cost efficiency, hybrid mechanistic-organic – the best total performance, and organic technical-batch – considered as the most innovative.

The second branch of Jing Hua Li's (2012) framework is a multi-participant paradigm of service innovation emphasizing the stakeholders' domination. It distinguishes new types of innovations, such as stakeholder innovation (Smith and Fischbacher, 2005; Sheng et al., 2007), open innovation (Chesbrough, 2003; Chen and Chen, 2006) and total innovation (Zheng, 2006; Xu, 2007). The main idea of this multi-participant paradigm is the triangle model – 'main service provider – partners – customer' (Lu et al., 2010). It shows that service innovation can be considered as a system including all parts of service chain, such as service production, consumption, service design, etc. (Jing Hua Li, 2012).

The third branch includes the factor of customization in services which arises from service provider and customer interaction, and which is rationalized by mass manufacturing (Peters and Saidin, 2000). In this case a new service is a result of the service provider and customer together. The forth branch identified by Jing Hua Li (2012) is service enhancement manufacturing. Here service innovation occurs as a result of manufacturing and service interaction. It becomes independent business of manufacturing (Davies, 2004). This means, when a manufacturing company introduces a product, the need of services, such as a product design, marketing, brand and financing, appears (Wise and Baumgartner, 1999). These kinds of services for manufactured products become areas of service innovation.

Moreover, recent research provides one more paradigm of service innovation which is the 'open innovation paradigm' (Chesbrough, 2003). It is an emerging concept of service innovation which contradicts those previously discussed and considers them as closed and unsustainable innovations. Chesbrough (2003) describes open innovation as 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively' (Wynarczyk, 2013). Therefore, open innovation allows companies to use external and internal paths to the market, such as existing technologies and know-how, fosters collaboration with other organizations and institutions, such as universities and etc., and provides better opportunities to gain advantage and commercialize new service innovations (Chesbrough, 2003; Laursen and Salter, 2006; Clausen and Pohjola, 2009; Gassmann et al. 2010).

3. Commercialization of innovation

Commercialization of innovation can be described as a sum of activities required for introducing innovation to the market (Nerkar and Shane, 2007; Nambisan and Sawhney, 2007). Burgelman, Christensen, & Wheelwright (2006) broaden this definition and state that these activities lead to new, marketable products and services, or new product-delivery systems. These activities include the development of production and marketing capabilities, assets, such as manufacturing facilities, service and distribution networks, management involvement, organizational culture etc.

According to Nerkar and Shane (2007), success in commercialization of innovations is of strategic importance to firms, because it helps to dominate markets or develop new markets, which contribute to the leadership in an industry (Wallsten, 2000). However, only one of every 3000 new innovation ideas is commercialized into a successful product (Stevens and Burley, 1997), because of the four innovation phases mentioned earlier. When innovation is first introduced to the market, the first ones to adopt it are technology enthusiasts, so innovation is held successfully commercialized when it reaches the 'mainstream' market of conservatives (Moore 2000). A firm's capacity to reach the mainstream market as fast as possible defines the success of commercialization. However, Teece (2010) provides another important insight. He states that while commercializing a new product or process the first, a company does not necessarily make profit from innovation, which is often captured by a fast second or third entrant. In 1986 he added the concept of 'Profiting from Innovation', which is a framework that provides the explanation for the influence of managerial decisions, intellectual property protection, and the asset structure of a firm, which helps capture value from its innovation.

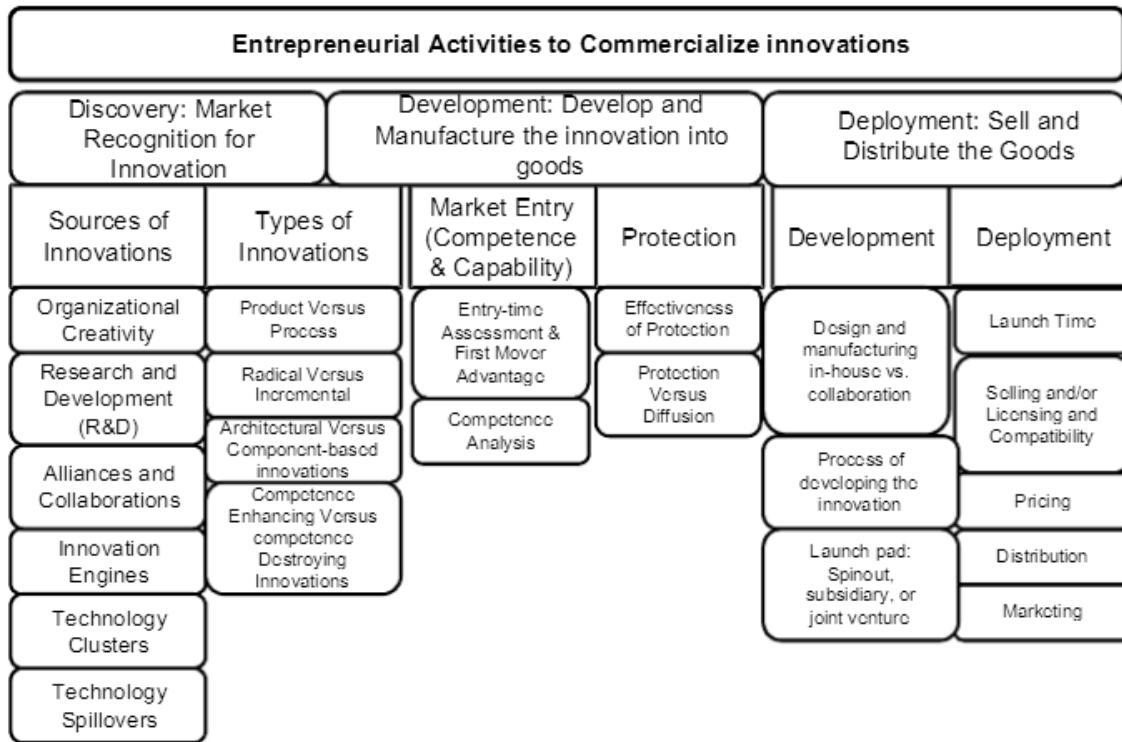


Figure 2. Entrepreneurial steps to commercialization of innovations.

Source: Crossan, M. M. Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management Studies*. Vol. 47, No. 6, p. 1154-1191.

Figure 2 complements Teece's framework and represents how the process of innovation commercialization is distributed over six main topics: *innovation source*, *innovation type*, *market entry*, *protection*, *development* and *deployment*. The innovation sources-related literature also outlines:

- Organizational creativity – 'a function of creative individuals and a variety of social processes that shape the way individuals interact and behave' (Woodman et al. 1993, Schilling and Phelps, 2007);
- R&D as a key and a source for new ideas, sales from new products and profitability. (Roberts, 2001, Hagedoorn, 2002);
- Alliances and collaborations – diverse entities create an opportunity to commercialize innovations, because of knowledge sharing and transferring (Anderson, 2008), for example, networks of customers, suppliers or competitors, which generate new product ideas and help to share knowledge;
- Innovation engines, in other words – universities and government, these two institutions invest and create policies to foster growth of innovations by creating technology transfer offices, incubators, laboratories, and offering grants (Wallsten, 2000, Cohet et al. 2002);
- Technology clusters – a high density of firms in one geographical area often leads to new start-ups of technology firms, that are highly innovation-productive (Stuart and Sorenson, 2003);
- Technology spill overs – a 'positive externality from R&D resulting from the spread of knowledge across organization and regional boundaries' (Schilling, 2006).

To continue, *four main dimensions of innovation* need to be discussed in-depth in order to understand the process of commercialization:

- Product vs process innovations – innovations in improving the effectiveness and efficiency of production, such as reducing defect rates or improving supply chain mechanism, which often result in innovative outputs of production – product innovations (Schilling, 2006, Klein et al, 2007);
- Radical vs incremental – two opposite types, where the first means new and totally different innovation, which results in radically new products and services, and the second, which often follows the first one and involves adaptations, refinements to existing products and services (Burgelman et al. 2006);
- Architectural vs component innovations – architectural innovations tend to change the overall structure of a system or the interaction between system components – they often redefine product functionality and even drive market innovation. Component innovations have benefits for individual components but do not affect the overall structure of a system (Christensen, 1992);
- Competence enhancing vs competence destroying innovation – some innovations enhance existing knowledge base and some do not, but instead build new competences.

The market entry concentrates on three main activities: entry time assessment, first mover advantage and competency analysis. Most scholars analyse entry time assessment and first mover advantage together, because they are highly related and often tend to overlap. Entry time assessment is a function of the margin of advantage deriving from a new innovation, the state of enabling technologies, the state of complements, the state of customer expectations, threat of competitive entry, whether the industry faces increasing returns, and firm's resources (Shaw, 1984, Aaker and Day, 1986, Makadok, 1998, Schilling, 1998, Shamise et al, 2004). The successful assessment of entry times gives a first mover advantage, which has many benefits, such as: brand loyalty and reputation, capturing scarce resources, increasing returns from learning-curve effects and network externalities (Urban et al, 1986, Lieberman and Montgomery, 1988). Despite that, there are some disadvantages as well: consumer ambiguity, poorly developed infrastructure of suppliers and distribution channel and high technology and R&D costs (Shaw, 1984, Lieberman and Montgomery, 1988, Shamise et al, 2004). The competency analysis includes the company's ability to distinguish itself in the market place (Prahalad, 1993). It is achieved through the combination of skills and resources – in order words – harmonizing technologies, asset interactions and organizational routines all together (Reed and Defillipi, 1990, Barney 1991)

Since innovation is considered as intellectual property, an important stage of the commercialization process is the *protection*. The biggest issue is the appropriability, (this term is related to discussions on intellectual property rights and factors influencing the value creation from innovations) which is the issue of how quickly an innovation can be imitated (Cohen and Levinthal 1990). Three main tools for the protection of innovation are: patents, trademarks and copyrights. Their efficiency is different in different industries, for example – they are more beneficial in biotechnology industry than in electronics and software (Schilling, 2006, Burgelman, 2006). These tools help companies fight reverse engineering, which is a big issue and makes the process of protecting intellectual property difficult, especially, when the mobility of knowledge workers is high (Schilling and Phelps, 2007).

Another important issue is the choice between protection and diffusion. Most companies neither use one or the other, because both strategies have advantages and disadvantages. Strict protection means higher earnings on rents, which can be reinvested into further development of technology; it preserves architectural control and enables the company to win against competitors (Henderson and Clark, 1990). On the other hand, the diffusion promotes distribution of technology and accelerates its development. Shane (2002) and Burgelman et al (2006) suggest that it is best to control standards through licensing or to have a dominant design that ensures monopolistic rents. Diffusion is the best tactic when a company has neither adequate resources to be the only developer, producer,

distributor and marketer (Garud et al, 2002) nor has strong competitors, who can quickly develop a better version of technology (Hill, 1992).

In the *development* phase, a company needs to decide on three main issues:

- Manufacturing in house or creating alliances and joint ventures with other firms – it depends on many factors, such as possession of resources, availability of technology, importance of controlling the development process and the access to another firm's capabilities (Kwak, 2002, Soosay and Hyland, 2008). Usually firms that have necessary capabilities to develop a product and want to protect their technology choose in-house manufacturing. Collaboration also increases the time between conceptualization to commercialization of innovation (Golder et al, 2008). However, collaboration gives advantages, such as sharing risks and costs, combining skills and resources, transferring knowledge, and creation of shared standards (Gulati and Gargiulo, 1999, Litan et al, 2007, Provan et al, 2007). Therefore, forms of collaboration such as strategic alliances, joint ventures, licensing and outsourcing occur (Barringer and Harrison 2000, Provan et al, 2007).
- The process of innovation development – innovation commercialization literature outlines three objectives that need to be achieved in order to ensure successful product development: maximize fit with customer requirements, minimize entry time and control development costs. Different authors emphasize different means to achieve these objectives. Cohen and Levinthal (1990) suggest paralleling development processes among marketing, manufacturing, and R&D. According to Cristiano et al. (2001) and Lilien et al (2002), it is crucial to involve customers and suppliers in product development to ensure the quality and sustainability of a product, satisfying consumer needs, which help to minimize the cost and fasten the market entry. Finally, Schilling (2006), Litan et al (2007) suggest employing various stage-gate processes and CAD/CAM (Computer added design/manufacturing) tools for blueprinting, reducing cycle times, improving product quality and controlling development costs.
- Launch form – there are many ways to launch an innovation. Besides a traditional way of launching solely by one firm, there are other means as spin-outs, subsidiaries or joint ventures. According to Burgelman et al. (2006) it usually depends on the scope of innovation or the risks of market entry.

Deployment – the last stage of innovation commercialization, where the most important issues are launching time, licensing, compatibility, pricing, marketing and distribution. This stage includes the revision of the business cycle, seasonal effects; decision whether to sell out or license an innovation; pricing techniques, such as penetration pricing or market skimming; distribution methods – whether it is through the website, mail or intermediaries; and marketing efforts, which include cost, reach, content, targeting, innovation positioning, image, reputation etc. (Slater and Mohr, 2006).

During the described process of commercialization, the literature outlines the two most important issues that companies should focus on. The first topic, which, according to Zahra (1996), should be considered is whether to leave development and commercialization in house, commercializing with others using alliance or licensing method or selling to others to commercialize. Usually these decisions are impacted by the amount of profit available and company's existing capabilities to commercialize the innovation. When capabilities are available innovation development will be executed in-house, but if they are not – most probably a company will choose to source them externally, which will reduce rental costs. Kogut and Zander (1996) provides a solution to develop capabilities internally by assessing the current knowledge, exploring newer technologies and organizing principles into future market developments. However, this requires a long term investment and does not provide immediate results.

In case of unavailable capabilities, but high possible returns from innovation, Friedman (2006) suggests finding partners or licensing the innovation out. The same suggestion is applicable if potential returns are low, but capabilities are available. Schilling and Phelps (2007) noted that firms could not ensure their dominance in terms

of technology of an innovation and secure industry-wide advantage by licensing. By creating complementary assets a licensor gains tacit knowledge. Finally, when potential profits are low and capabilities are not available the best option is to sell the innovation. This would minimize the risk for a firm assuming the deal would not end up with a buyer becoming a future competitor.

Another important issue, which should be considered by companies is that radical innovation have significantly higher value than incremental ones. O'Reilly and Tushman (2004) suggest that radical innovation is very important to the firm longevity, and successful firms tend to develop radical products without hurting existing markets. In other words, the more radical innovation is the bigger competitive advantage a company can gain. An important issue for companies is how to enter the market with a radical innovation. Since radical innovations require new capabilities and even new venture to drive the innovation, there is a high possibility of licensing the technology or developing it together with partners. In the case of a very high potential profit, a company might consider in-house commercialization, which might be done by creating a separate division, performing a spinout or integrating with existing in-house activities.

To stay competitive in the market, a firm has to perform well in many areas of business. Firstly, it should create the environment available for knowledge sharing and diffusion, which is supported by a variety of internal mechanisms. Secondly, it is crucial to create alliances with external partners in order to access direct resources, knowledge and capabilities. Thirdly, firms should employ innovation engines, such as universities, research organizations and laboratories. And finally, firms should create an organizational culture and an internal company network, where the top management are visible and reinforce commercialization process (Nevens et al. 1990). In this way, a nurturing environment for innovation commercialization is created, deadlines are met, decision making is fast and internal social relations exist.

4. Innovation in fast food companies

The fast food restaurant industry is a significant and growing sector of the overall food industry, providing a quick and convenient service at a relatively low cost. Based on the English dictionary, a fast food is a type of meal that is often pre-prepared and served quickly (Anand, 2011). Monitor (2005) proposes a definition of the fast food industry stating that it is the sale of food and drinks for immediate consumption either on the premises or in designated eating areas shared with other food service operators, or for consumption elsewhere (Anand, 2011).

In contrast to technology-based industries where innovation is perceived as a vital factor for business development, in the food and beverage industry service providers and users are conservative in terms of radical changes in production and consumption (Sarkar and Costa, 2008). Beckerman and Skjolkebrand (2007), after research done on the degree of innovativeness in the food industry, conclude that few innovations are introduced to the market due to consumer risk aversion. Low involvement in service innovations of the food and beverage industry compared to technology-based industry is also affected by a low budget contribution to research and development (Christensen *et al.*, 2006; Avermaete and Viaene, 2002; Wilkinson, 2002; Steward-Knox and Mitchell, 2003; Galizzi and Venturini, 2008), which is considered as one of the most important factors leading to service innovations (Toivonen and Tuominen, 2009). In addition, compared to industries like the pharmaceutical and computer industry, there have been significantly fewer products introduced to the market over the past ten years, and fewest patents for new products registered (Mersiha Tepic *et al.*, 2012). Nevertheless, in recent years, changes in trends and perceptions of society in food consumption required the response of technical and economic changes in the production of food (Anahita Baregheh *et al.*, 2011). Hence, innovation is an important factor in expanding a competitive market (Capitano *et al.*, 2010; Grunert *et al.*, 1997; Rama and Von Tunzelmann, 2008).

Companies, instead of looking for technology-based innovations, focus mostly on recipe development, trying new marketing strategies and operational improvement. Key factors for increasing operational advantage of international

fast food organizations are high volumes, standardization, centralized planning, human resource and aggressive marketing. Mahmoud M. Yasin *et al.* (1992) describe fast food restaurants as a unique operational system designed to provide customers with efficient and responsive services. For this reason he distinguishes three operational areas where innovative improvements are essential for fluent work of fast food restaurants, which are: input, processing and output subsystems. A successful operation of any fast food restaurant is underlined by co-operation and development of these subsystems (Mahmoud M. Yasin *et al.*, 1992). In order to improve the efficiency, quality and responsiveness of service, fast food companies must pursue the service innovation of the internal operational environment including ordering and stocking systems, inventory management and customer service etc.

Looking through the history of innovations commercialized in the fast food industry it is crucial to mention technological and operational improvements that lead large companies to increase service efficiency and gain competitive advantage. For example, Kentucky Fried Chicken Corporation in the 1930s introduced 'vegetable pressure cooker to fry chickens', which reduced waiting time and improved the quality, as well as reduced preparation time, leading to lower labour costs (Kimes *et al.*, 1999). Another example is McDonald's which presented make-to-stock, assemble-to-order and work-to-process concepts (Davis *et al.*, 2002). As a result, these innovations in internal organization had an impact on the whole service quality and work efficiency.

Consequently, the fast food industry was influenced by innovative American fast food giant companies such as McDonald's, Kentucky Fried Chicken, Pizza Hut, Domino's, etc., which successfully expanded their business internationally (Ritu Anand, 2011). The fast food industry was highly affected by traditional American style food, which included pizzas, hamburgers, chicken burgers, etc. Nevertheless, given the changing trends and increasing popularity of perception towards healthy style of living, fast food companies started to pay more attention to healthy food and product availability (Bijnen *et al.*, 2002). As fresh food popularity increased, such companies as Maid-Rite, Subway Sandwiches and Cozi emerged and differentiated themselves as healthy-style fast food restaurants by introducing healthy baked bread and other fresh ingredients (Cha, 2006). As an example, Iranian fast food company Shila was established in the local market in 2002, successfully positioned itself on the healthy food market and became the fastest selling company in the local market (Momtaz *et al.*, 2013).

The research of Matthyssens *et al.* (2008) highlights value innovation as a driving factor of new processes and business models in the functional food industry. Value innovation is perceived as a reconceptualization of a business model and delivery modes (Matthyssens *et al.*, 2008) and considered as disruptive innovation leading to the establishment of new markets and disruption of industry leaders (Christensen *et al.*, 2002). This kind of innovation proposes radical changes in the food industry creating opportunities for new products and services. Matthyssens *et al.* (2008) explain that value innovation occurs in the value chain of food industry where suppliers, midstream companies such as Unilever, Nestle and P&G, and retailers are involved in the innovation process. The author identifies three management aspects that innovative food companies develop in order to realize value innovation. They are the market sensing generating deep customer insight, complemented with the building of a real entrepreneurial culture and with value chain management competences (Matthyssens *et al.*, 2008).

Going deeper to the analysis of the fast food industry of rapidly developing economies, an overview of such countries as Lithuania is important to understand the regional peculiarities of this industry. For instance the importance of catering services is increasing in Lithuanian household consumption (Anna Dabrowska, 2011). It is still relatively small, compared to developed countries, but there is a rapid expansion forecasted in a 10-year period. There is a visible moderate expansion of the fast food market in Lithuania. It is happening because of the population's standard of living, modernized consumption structure and shift in consumer perception on fast food. This is also influenced by the globalization process, socio-political changes and new market entrants, such as McDonald's, Pizza Hut, KFC and Subway (Subway has opened the first restaurant in Lithuania on May 1st, 2014). Furthermore, the fast food market is highly related to saving time, thus, catering services are gaining higher importance.

According to the ‘Study Report on Franchising Attractiveness of Lithuanian and Latvian Border Regions’ conducted by Brand4balticC research agency, the Lithuanian market is recognized as an emerging fast food, takeaway coffee, Turkish kebab and wine consumption market. Currently, the fast food market in Lithuania is led by international food chains, but there is noticeable increasing competition from local food chains. The most dominant type of food consumed in the current fast food market is pizza, but it is rapidly followed by exotic cuisines, such as Japanese, Chinese and Thai. Finally, the study report outlines that there is a noticeable upward trend of healthy food choices in the market.

5. Methodology

Relying on the argument that innovation commercialization is most successful when it reaches the mainstream market (when many people start using and acknowledging it), the intention was to find out what innovations in Lithuania are the most attractive for customers and could be the most profitable, as well as provide insights on how to commercialize them most efficiently. This research is relevant and innovative as little research has been conducted in the field of fast food restaurants. More popular areas are fine dining (Ottenbacher and Harrington, 2007), food manufacturing (Harrington, 2004) or studies that are not applicable to the current environment. Furthermore, frameworks deriving from previous research pay insufficient attention to customer research and lack theoretical marketing concepts. Most of studies use a case study approach. Within the present research a qualitative research method is used to analyse the internal commercialization process in fast food companies. This ensures that results are accurate and detailed and provides an extensive overview from the enterprise perspective.

The qualitative research method, expert interviews, was used to find out if companies in Lithuania pay any attention to innovation commercialization process and to compare them with international companies in order to acknowledge if the process is facilitated while using techniques described in the innovation commercialization literature. The commercialization process is a more theoretical process, which mainly addresses theory building rather than theory testing. Ghauri et al. (1995) claim that a qualitative research is appropriate to use in organizational research when the goal is to better understand complex issues and processes that would not be apparent in survey responses. According to Carson and Coviello (1996), detailed qualitative data can only be obtained by getting physically and psychologically closer to the phenomenon through in-depth interviews. This conclusion was also confirmed after reviewing other research made on innovation commercialization. The table represents a summary of previous research carried out on innovation commercialization, which contributed to the development of the methodology used in this research paper.

Table 2. Overview of innovation research.

Name, Author, Year	Methodology	The Goal	Results
A customer oriented new service development process. Ian Alam and Chad Perry (2002)	Elite quasi-structured interview method to probe the processes used by managers in developing new services for their firms. Open-ended questions and some five point Likert scale questions with “very important and “not an issue” as anchors. Interview protocol was developed using prior theory.	The goal of this paper was to develop a model for new service development and analyse customers’ input to new service development	Developed a framework for new service development, emphasized the importance of a customer.

Value innovation in the functional foods industry: Deviations from the industry recipe. Paul Matthyssens, Koen Vandenbempt and Liselore Berghman (2008)	Five exploratory interviews with industry experts and product managers of different functional food suppliers and in-depth study of secondary material.	To observe value innovation initiatives in the functional foods industry	Proposed three categories of management practices that innovative food suppliers seem to develop in order to generate new value concepts. Emphasized the importance of entrepreneurial and competence building culture and innovation blockers.
The product innovation process of quick-service restaurant chains. Michael C. Ottenbacher and Robert J. Harrington (2008)	Semi-structured interviews with six highly respected restaurant chain executives from six different organizations	To outline the innovation process activities described by quick-service restaurant (QSR) managers and to compare it with an earlier QSR process model and with those used in other food service settings.	Emphasized the importance of iterative screening, testing and feedback loops to reduce risk of failure, increase product quality and improve customer satisfaction. Outlined the need for market research as well as the use of “platforms” to build on earlier learning, speed the process and increase efficiency.
The innovation development process of Michelin-starred chefs. Michael Ottenbacher. Robert J. Harrington (2007)	12 semi-structured interviews with Michelin-starred chefs in Germany from total 190 restaurants in Germany.	To compare and contrast the innovation process described by Michelin-starred chefs with existing theoretical innovation process models.	Outlined similarities and differences to traditional concepts of new product development, emphasized the important role of employees in innovation process
Exploring the synergy between entrepreneurship and innovation. Fang Zhao (2005)	6 semi-structured interviews were conducted to examine the perceptions of senior managers regarding entrepreneurship and innovation, and the factors that contribute to the development and integration of entrepreneurship and innovation.	To study factors affecting the development of entrepreneurship and innovation, and how interaction between them affects the commercialization of innovations.	Entrepreneurship and innovation are positively related and complementary, however they are not confined to the initial stages of a new venture; rather, they are dynamic and holistic processes in entrepreneurial and innovative organizations.

Source: Prepared by paper authors, according to Alam, I. Perry, C. (2002), Matthyssens, P. Vandenbempt, K. Berghman, L. (2008), Ottenbacher, M. C. Harrington, R. J. (2008), Ottenbacher, M. C. Harrington, R. J. (2007 and Zhao, F. (2005).

Further analysis employed a semi-structured interview model for data collection. This method is flexible, because there is always a possibility to change questions according the flow of the interview and adapt to the situation. A survey prepared in advance was used to collect a necessary data from respondents. However, respondents could talk freely and add anything they wanted to their answers without any interruption, and their anonymity was ensured.

The questionnaire was composed of five questions: there were four open-ended questions and one Staple-scale based question, where respondents were asked to evaluate the importance of innovation in their business from one to ten, one meaning not important and ten very important. Questions were provided in a chronological order, firstly by presenting the analysis, then asking to state one or some specific innovations, that were implemented by a company. This was then followed by two questions about differentiation and business success factors; one Staple-scale based question was asked in order to examine the importance of different innovations in business and finally, an open question was related to the commercialization process within a selected company. The average length of an interview reads 15-20 minutes.

A small sample used for this analysis, four restaurants, is enough to represent the Lithuanian market, to compare opinions of various respondents accurately as well as to make conclusions and foundations for future research.

There were three successful and innovative, international fast food chains operating in Lithuania as well as one small Lithuanian based fast food company selected. This allowed comparing International and Lithuanian service innovation commercialization processes and providing recommendations accordingly. Four experts representing fast food restaurants were chosen. According to Bitinas (2008) – expert is a status that is given to a person by a researcher, according to the field and topic of a study. An expert has a lot of knowledge and experience in the field, which is not available for everybody. He/she is able to share it and contribute to a study. He is the main source of information. In the present study, a set of franchise owners were selected as experts, having in mind the size of restaurants.

Chosen respondents:

- “Petros Chilli and Chips” – U.S based traditional fast food restaurant, operating on a franchise model. The Head marketing director filled in the online survey.
- “Wok to Walk” – a chain of successful Thai food restaurants, where people can order fresh, takeout food, which is prepared in 5 minutes. It is based on a franchise model. The interview was conducted with the franchise owner in Lithuania.
- “Subway” – a customizable sandwich restaurant, with 41782 restaurants around the world. It is based on a franchise model. A face-to-face interview was conducted with the franchise owner in Lithuania.
- “Jammi” – medium-sized Lithuanian 24/7 kebab restaurants chain, with 6 restaurants in Vilnius. During an interview, the restaurant owner was questioned.

The comparative analysis was used in order to summarize and compare research results. The main goal of this type of analysis is to evaluate the respondents’ perception on the topic, according to his/her experience and explain the difference between theoretical description and business reality. In order to make extensive and viable analysis of commercialization processes it is most appropriate to overview commercialization processes according to the framework provided in the theory of innovation commercialization. Experts’ answers to interview questions helped to test this framework and provide accurate insights about the process.

6. Results

Service innovation commercialization peculiarities in fast food companies

Planning, organising and managing sources for innovations are one of the most important stages of the commercialization process. Figure 3 provides an overview of existing sources of innovation, which were identified by fast food restaurants’ experts.

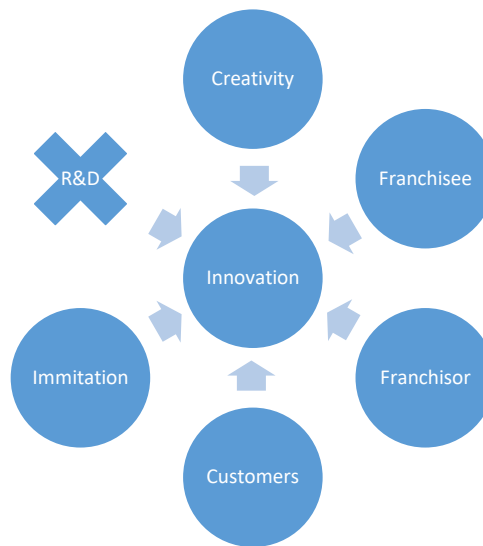


Figure 3. Sources of innovation.

Source: Prepared by authors, according to experts' answers.

The most significant source of innovation in the fast food companies questioned is *organizational creativity* – all four experts outlined the importance of creativity in their companies. Experts also mentioned several tools to reach it, such as staff meetings, innovation days (where all employees brainstorm and generate new ideas) products or services (employees of “Jammi” introduced their famous kebab soup, which now is one of the most popular dishes), magazines, international exhibitions, etc. Another important source of innovation is a relationship between *franchisor* and *franchisee*. Three of four analysed food chains are based on a franchise model, which gives a lot of information about commercialization process in franchise-based fast food chains.

Experts mentioned that innovations can arise in two ways. Firstly it can be encouraged by a *franchisor* – usually technological innovation, implementation schemes and “know-how”. Secondly, innovations can be induced by a *franchisee* - owner of a franchise in a specific country, who is responsible for innovations in that unit. Usually these innovations are affected by demographical characteristics of the restaurant location and adapted to customers' behaviour of that area. For example, one expert mentioned, that a new unit in Lithuania is the only one out of 41,782 restaurants in the world, which decided that adding sauce in the middle of sandwich making process would save time. Since Lithuanian customers are inexperienced and unfamiliar with new types of sauces served in that restaurant, adding sauce in the middle of the process would give them more time to decide about the sauce, because they have to wait while their sandwich is toasting in the oven. This saves around 20 seconds per customer. Serving 4000 customers a week saves around 22 hours a week. The main goal of this process innovation was to reduce the number of customers standing in the queue and be more efficient in serving them. It is a good example of how innovation was implemented by a franchisee's efforts. These types of innovations might be also transferred to an international level.

Thirdly, an important source of innovation is customers and community. Three of four experts mentioned that they try to involve customers and community in ideas generation and commercialization process. Companies participate in events such as Fall Festivals and Fun Days, etc., also gather feedback and have “create your own food” campaigns. Finally, it is worth mentioning that imitating international chains might be considered as a source of innovation. All experts shared strong opinion that it is crucial to observe other restaurants in order to improve services and develop new ones. In addition, none of the restaurants which were interviewed has separate R&D departments for new product development. That is because all units are small. They do not have the capability and

resources to implement such activities and are not highly related to technology, which is the main interest of most R&D departments.

Furthermore, it is necessary to analyse what types of innovations are most frequently implemented by fast food companies. Innovations are highly related to differentiation and positioning in the market, because they give competitive advantage and first mover advantage. Experts were asked to identify specific innovations that helped to gain competitive advantage and differentiation on the market in order to find out the extent of innovativeness in each company and to make conclusions about the type of exercised innovations. Figure 4 summarises the results regarding all innovations mentioned during the interviews: four main types of innovations were noticed.

Product	Process	Service	Marketing
<ul style="list-style-type: none"> •Kebab soup •Customizable sandwich •Freshly baked bread 	<ul style="list-style-type: none"> •Putting the sauce in the middle of sandwich making process •Innovation days •Opening a unit in church •Selection of free vegetables and sauce 	<ul style="list-style-type: none"> •First drive-through kebab restaurant •Sandwich made in front of customers eyes •Choosing a drink from a touchscreen (Self-service) •Working 24/7 	<ul style="list-style-type: none"> •Foursquare application •Beta.It coupons •Emotional connections marketing

Figure 4. Types and examples of fast food innovations.

Source: prepared by authors, according to experts' answers.

Most of these innovations are incremental, since all improvements are supplemented with existing measures, according to the needs of customers, and not highly related to technology. Furthermore, it can be outlined that, according to organizational characteristics, innovations in fast food companies can be divided into external and internal innovations, mostly dominated by external ones, which are mostly related to customers. Innovations, such as 'innovation day' or putting a sauce in the middle of a sandwich making process are considered to be internal innovations, because they are implemented inside the organization, and customers are not aware of that. Nonetheless, mostly fast food companies apply external innovations that are related to new products, services or new marketing concepts. Companies are mostly concerned about attracting and retaining customers. Thus, a conclusion can be made – fast food companies concentrate on marketing innovations, which were most widely mentioned by experts. All these innovations brought many advantages, such as: 'Strengthened relationship with customers', 'saved 22 hours a week', 'created a habit through innovation', 'returning customers', 'customer satisfaction', 'long term reputation', 'improved efficiency', 'competitive advantage' and 'raving fans'.

The next stage of commercialization is the market entry and protection. None of analysed companies had first mover advantage; none of them were first to enter a market with a completely new product or service, but continuous incremental service, process and marketing innovations ensured a significantly high market share and returning customers. This allows companies to evade the customer ambiguity and poorly developed infrastructure of suppliers and distribution channels. The research confirms Schumpeter's (year), Lundvall's (year) and Drucker's (year) ideas that a pure new idea does not by itself lead to implementation and has to be managed by a strong personality (entrepreneur, franchisee) and implemented through his/her influence. Furthermore, innovation does not necessarily have to be technical, but can be related to knowledge management, which enables people, with different skills working together with an organization, to explore new opportunities.

This reveals that the Lithuanian fast food market is mainly based on service, process and marketing, rather than product innovations. The research also revealed that companies do not use any protection tools for innovations. None of the experts mentioned patents, trademarks or copyrights. However, protection methods are not as relevant, since mainly service and process innovations are commercialized and protection tools are usually used for technological innovations. This innovation diffusion strategy makes it easier for new entrants to establish themselves in the market. This is why the fast food market is constantly entered by small competitors, which have their own small customer base or drop out very soon, due to a lack of resources and experience. This does not create an issue for the bigger companies analysed by this research.

The next stage outlined by innovation commercialization literature is development. The survey revealed that fast food companies mainly use in-house operations to develop and commercialize innovations. The exception is when a franchisor transfers technological innovations and standards to the franchisee, for example – food preparation and equipment schemes. This collaborative method allows saving costs, which provides an advantage over other companies that take care of their innovations and operations on their own behalf. Another form of collaboration mentioned by experts was partnerships with other businesses to help each other to reward employees and provide programs and services for their customers. This is more linked to process innovation rather than technological innovation. It also ensures sharing knowledge and standards, which eventually leads to a successful process of innovation commercialization.

It is important to mention that all interviewed food chains screen new food ideas in regards to operational aspects. A good example was outlined by one expert – a new entrant to the Lithuanian market (worldwide restaurant “Subway”), decided to not show any marketing efforts and open quietly. This choice was made in order to:

- screen products and services
- identify if it had all the necessary equipment to prepare food
- enhance employees’ skills and knowledge to serve customers quickly and according to high standards
- to see if new ideas and innovations are acceptable in the Lithuanian market.

This market entry technique is innovative in itself, but it is only applicable for companies with a well-known brand, which has a well-established reputation.

During the interviews the most emphasized stage of the innovation commercialization process was deployment stage, especially the marketing part. Three of four experts mentioned various marketing innovations and emphasized the importance of continuously seeking innovative ways to reach customers, such as applying internet technologies (Foursquare, Beta.lt coupons), which is partly a technological innovation, employing new marketing schemes (emotional connection marketing, involving customers) and involving in-community activities (churches, schools, non-profit organizations). All these can be characterised as marketing innovations.

Figure 5 provides a summarized framework of innovation commercialization, which is revealed after questioning all four experts: one USA-based restaurant, two franchise-based international fast food chains with single units in Lithuania and one medium-sized local fast food chain. This is most widely applicable in the Lithuanian market, since three of four analysed restaurants are established in Lithuania.

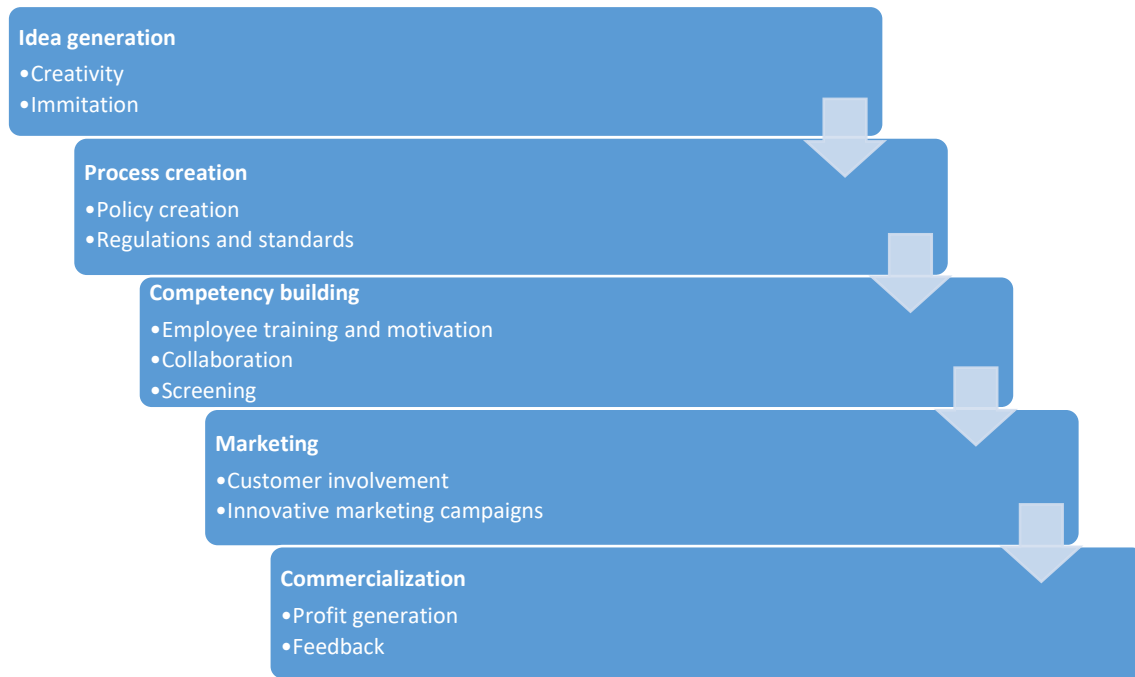


Figure 5. The process of innovation commercialization in Lithuanian fast food companies.

Source: prepared by authors, according to experts' answers.

It is obvious that this framework is simpler, than the one summarizing the scientific literature analysis results. This is due to several reasons. Respondents lack the knowledge and do not have a clear understanding about innovation commercialization process. There is a lack of information and processes are not developed to their full potential. Respondents had difficulty expressing how their innovations generate profit in a restaurant. Experts mentioned that they 'do everything on their own', use 'trial and error method', 'never thought about it'. The commercialization process is often led by one leader, who is also owner of the restaurant. He/she is responsible for starting the idea generation process or generating ideas on his own; he also creates policies, trains and motivates employees, creates marketing campaigns and collects the feedback. Not having a well-developed innovation commercialization process has many drawbacks –knowledge sharing and diffusion is not promoted, which leads to an absence of innovative internal company culture; companies loose opportunities to maximize profits from innovations and to dominate in the market.

Figure 6 summarises activities in sampled fast food restaurants, which are executed correctly, according to the commercialization literature and those, which are completed incorrectly and should be improved.

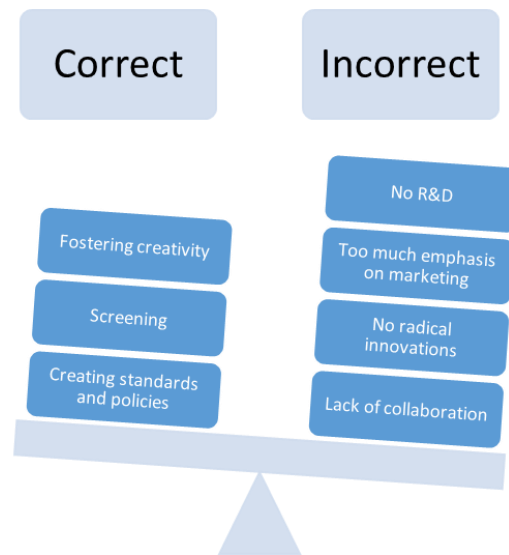


Figure 6. Commercialization process' pros and cons.

Source: prepared by paper authors, according to experts' answers.

In order to improve their commercialization process, companies should start investing in research and development activities, which would help to improve products and preparation processes. It would also help to make innovations more radical, to gain competitive advantage for a company. Concentrating more on the development stage rather than only on marketing would improve the quality and efficiency of the innovation process. Companies should also consider collaborating with other entities in order to develop innovations and improve technology, rather than performing all operations by themselves. All these incongruities slow down the process of innovation commercialization process and prevent companies from earning higher profits.

Interviews were also conducted to find out how experts evaluate the importance of innovation in restaurant selection criteria groups. They were asked to select a number on scale from 1 to 10 (1 meaning - not important and 10 - very important). The Results are summarized in the figure 7.

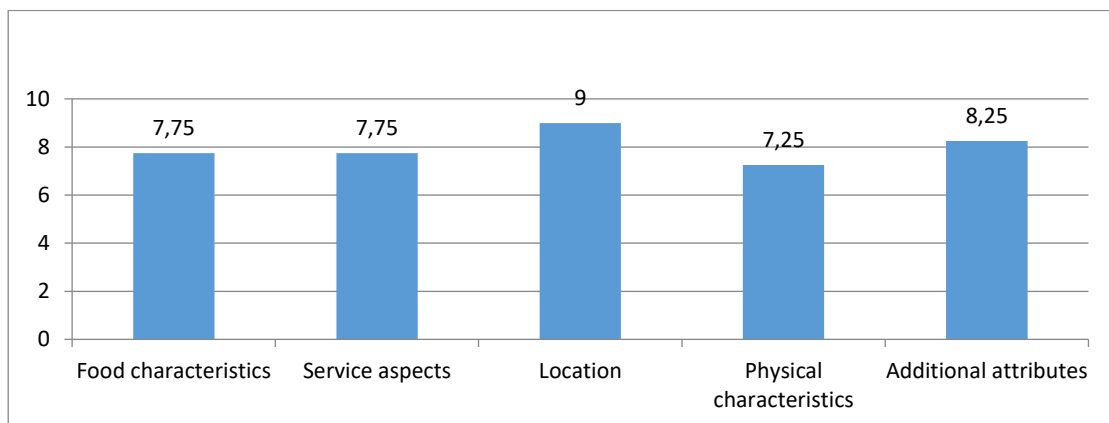


Figure 7. Means of restaurant selection criteria groups.

Source: prepared by paper, according to experts' answers.

From the figure above it can be stated that location and innovating in this area is the most important for fast food restaurants (mean – 9). Additional attributes, such as brand image, discounts, internet connection and etc., were evaluated as the second most important thing (mean – 8,25). Inventing in food characteristics and service aspects are equally important to experts – their mean reads 7,75, and physical characteristics, such as interior, modernity, free space and etc., were least important to experts (mean 7,25). These results emphasize the value of location for fast food restaurant owners and their relatively indulgent opinions towards food and service aspects. A further customer behaviour analysis should be conducted to reveal the importance of these factors to consumers, which should help to make necessary conclusions and provide recommendations for restaurant owners.

Conclusions and recommendations

This paper examined the innovation commercialization process from a business perspective with the emphasis on service innovation and its commercialization. Relying on research results, a new fast food market entrant should be able:

- to understand basic concepts and types of innovation that were overviewed in this paper
- to use the theoretical framework of innovation commercialization process
- to get familiar with the Lithuanian fast food market and innovations that are implemented
- to learn about innovation commercialization process in international and Lithuanian fast food companies
- to acknowledge main incongruities that occur in this process.

Companies should carry out regular marketing research, since one of the main sources of innovation in the commercialization process is a customer.

Main types of commercialized innovations among fast food restaurants are service and process innovations, followed by product innovations, which are not highly related to technological innovations. The research showed that an innovative fast food restaurant is more attractive to customers, so companies have to seek new ways to innovate and improve their innovation commercialization process, which currently remains undeveloped. In order to improve the commercialization process, companies should start investing in research and development activities, which would help to improve products and preparation processes; it would also help to make innovations more radical in order to gain a competitive advantage.

Focusing more on the developmental stage would improve the quality and efficiency of innovation process. Companies should also consider collaborating with other entities in order to develop innovations and to improve the technology rather than performing all operations by themselves. Among the questioned experts “Subway” had the best-developed service commercialization process, which involved the creation of a creative environment, innovative processes and innovation screening.

The Lithuanian market is highly suitable for well-known franchise-based brands and it is easy to enter the market by using this method. However, the further research is necessary to analyze the commercialization process among Lithuanian fast food companies more extensively and enhance the understanding about the relationship between internal and external service innovation commercialization aspects.

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Dr. Mindaugas LAUŽIKAS is an Associate Professor at Vilnius University Business School, Doctor of Economic Sciences, Director of GILE Experts (Malta). Lecturing experience in such countries as Georgia, Sweden, France, Spain, Malta, Moldova and Lithuania is supported by publications in the field of knowledge economy, entrepreneurship and innovation. Research interests: national systems of innovation, entrepreneurship, knowledge and innovation management, and human resource strategies.

Aistė MILIŪTĖ is a teacher/researcher at Vilniaus universiteto Verslo mokykla and entrepreneur within the mineral water and healthcare industries, a founder of AKVAVITA Company.

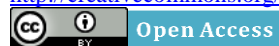
Lukas TRANAVIČIUS is a Researcher in the fields of innovation and marketing, interested in service innovations and performance optimization among companies via the market research and financial analysis techniques. Currently successfully combines the career of a researcher and manager.

Emilis KIČIATOVAS is a Researcher in the fields of innovations and the dynamics of small and medium enterprises, interested in innovative marketing instruments, innovation commercialization and entrepreneurship. Currently successfully combines the career of a researcher and manager.

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ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

MANAGEMENT DECISIONS FOR SUSTAINABLE DEVELOPMENT: MEDICAL SOFTWARE CASE STUDY¹

Laura Baronienė¹, Vytautas Žirgūtis²

¹ JSC "Softneta", Barsausko str., 59b, Kaunas

² Vytautas Magnus University, Economics and Management department. Daukanto str. 28, Kaunas

E-mails: ¹ laura.baroniene@softneta.com; ² v.zirgutis@evf.vdu.lt

Received 7 November 2016; accepted 6 December 2016

Abstract. Software is becoming increasingly important and pervasive in healthcare. Deaths and injuries, recalls related to the medical software, defective medical device statistics justify the practical dimension of the issue and needs to search ways seeking reduce possibility to arise injuries and deaths. Decision to release medical software to the market is very important not only to the manufacturer (design and development organization), but also for direct and indirect users (doctors and patients) and for all society, which is using national medical system with integrity information technologies possibilities. Manufacturers of medical devices assume responsibility for the correct functioning of medical devices and medical software manufacturer should assume responsibility for medical decisions making and medical decision influence on patient. This responsibility is related not only to the legal and financial risk, but also to the socially responsible business commitments. Software developing companies does not have knowledges about the conditions, which can assure medical software confidence before the release to the market. Such situations stops entrepreneur involvement in the medical software creating area.

Keywords: management decisions, medical software reliability, risk evaluation, acceptable risk, innovations

Reference to this paper should be made as follows: 2016. Baronienė, L.; Žirgūtis, V. 2016. Management decisions for sustainable development: medical software case study, *Entrepreneurship and Sustainability Issues* 4(2): 129-145.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(2\)](http://dx.doi.org/10.9770/jesi.2016.4.2(2))

JEL Classifications: O32

1. Introduction

One of the areas of significant growth in medical devices has been the role of software – as an integral component of a medical device, as a standalone device and more recently as applications on mobile devices. Software is becoming increasingly important and pervasive in healthcare. Given the availability of a multitude of technology platforms (e.g., personal computers, smart phones, network servers, etc.), as well as increasing ease of access and

¹ *Research and publication of results was funded by JSC "Softneta"*

distribution (e.g., internet, cloud), software created for medical purposes (software used to make clinical decisions) and non-medical purpose (e.g., administrative, financial) are being used in healthcare.

Manufacturers of medical devices assume responsibility for the correct functioning of medical devices and medical software manufacturer should assume responsibility for medical decisions making and medical decision influence on patient. This responsibility is related not only to the legal and financial risk, but also to the socially responsible business commitments. Decision to release medical software to the market is very important not only to the manufacturer (design and development organization), but also for direct and indirect users (doctors and patients) and for all society, which is using national medical system with integrity information technologies possibilities.

The **problem**, analyzed in this article, can be formulate as a question “How to manage the risk of business development of medical software creation for IT sector organizations?” Identified problem leads to the **goal** – to find algorithm, which comply with the legal requirements and would be useful and helpful to the medical software manufacturers.

The main tasks and research results would be following:

- Describe advanced research scope. This task creates possibility to identify limitations related to the medical software and created management decisions algorithm for sustainable development.
- Describe legal environment in different countries. This task helps to evaluate focus of legal requirements to the medical devices in different countries.
- Formulate of socially responsible solution assumption. This task helps to evaluate, how can be measured benefit of algorithm.
- Describe the adviced algorithm. This task helps to set sequencion and interaction of proposed actions, internal and external risk identification sources, which influence management decision.
- Describe how the algorithm was adopted for the "Softneta" medical device case. This task result must show algorithm adaptation results in user/ patient safety and medical software reliability aspects.
- Describe benefit of biomedical trials. This task results must show justification, why biomedical trials stage is necessary and useful.
-

Research object. “Softneta” is medical software creating organization. This implies the need to comply with the Lithuanian legal requirements for the medical devices. Case study is applied to the stand-alone medical device: software MedDream WEB DICOM Viewer. Indications for Use: MedDream WEB DICOM Viewer is as software medical imaging system used to receive DICOM images, scheduling information and textual reports, organize and store them in an internal format, and to make that information available across a network via web and customizes user interfaces. Software is intended for use as a diagnostic, review and analysis tool by trained professionals such as radiologists, physicians, clinicians. Contraindications: The MedDream is not intended for the acquisition of mammographic image data and is meant to be used by qualified medical personnel only who are qualified to create and diagnose medical image data.

According to the intended use of the device, MedDream is a stand-alone software that is specifically intended to be used for diagnostic purposes by viewing, archiving and transmitting of medical images. As it is not only suited for archiving or storage of data, it falls within the definition of an active medical device for diagnosis. MEDDEV 2.1/6 Annex 1 c1.4) links to the Manual on Borderline and Classification in the Community Regulatory Framework for Medical Devices, as it addresses the issue of PACS software systems. MedDream has no post-processing functions, as well as no control of image acquisition. Also it doesn't drive any other medical device, nor influence the use of a medical image source device, so implementing rule 2.3 “Software, which drives a device or influences the use of a device, falls automatically in the same class.” is not applicable and standalone software could be classified in its own right. MedDream allow direct diagnosis from image, also can apply multi-planar reconstruction for the better diagnosis. Based on the above mentioned considerations, Rule 10 could be appropriate and MedDream is classified as a Class IIa active medical device.

To ensure safety creation and maintenance medical software, which belongs to the Class IIa medical devices, should be implemented EU requirements for medical software. Medical software distribution in USA conditions requires FDA (Food and Drug Administration) approval/ clearancy, therefore FDA requirements for medical devices also should be implemented and maintained.

Softneta” present their social responsibility by creating rationale management decisions algorithm for sustainable development. This algorithm, created according to the medical devices related legal requirements, standards and good design and development practices, gives answer to the question “when the medical software ensures enough reliability and can be released to the market?” and eliminate restrictions, therefore can be used by other medical software creating organizations.

Methods applied: literature review was used for the article problem justification. Identified problem relevance was approved and legal environment analysis was made by analyzing primary and secondary data sources. Legal requirement analysis results were presented by using benchmarking. “Softneta” case study results were analyzed by using statistical analysis. Conclusion were formulated by using induction and deduction principles.

Literature review. In the US alone, iatrogenic or medical errors are responsible for 100.000 deaths and injuries every year (Kohn, Corrigan, Donaldson, 2000). Dr. Martin Makary claims that medical errors are now the third leading cause of death in the US (Makary M., 2016). The total cost of all medicinal errors in the US has accumulated to approximately 50 billion \$ (Bond, Dewar, Finlay, Nugent, Moore, Guldenring, 2014). European data, mostly from European Union Member States, consistently show that medical errors and health-care related adverse events occur in 8% to 12% of hospitalizations. For example, the United Kingdom Department of Health, in its 2000 report *An organisation with a memory*, estimated about 850 000 adverse events a year (10% of hospital admissions). Spain (in its 2005 national study of adverse events) and France and Denmark have published incidence studies with similar results. Infections associated with health care affect an estimated 1 in 20 hospital patients on average every year (estimated at 4.1 million patients) with the four most common types being: urinary tract infections (27%), lower respiratory tract infections (24%), surgical site infections (17%) and bloodstream infections (10.5%). Multiresistant *Staphylococcus aureus* (MRSA) is isolated in about 5% of all infections associated with health care. The United Kingdom National Audit Office estimates the cost of such infections at £1 billion per year. While 23% of European Union citizens claim to have been directly affected by medical error, 18% claim to have experienced a serious medical error in a hospital and 11% to have been prescribed wrong medication. Evidence on medical errors shows that 50% to 70.2% of such harm can be prevented through comprehensive systematic approaches to patient safety. This statistics, given from World Health Organization regional office for Europe, show that strategies to reduce the rate of adverse events in the European Union alone would lead to the prevention of more than 750 000 harm-inflicting medical errors per year, leading in turn to over 3.2 million fewer days of hospitalization, 260 000 fewer incidents of permanent disability, and 95 000 fewer deaths per year. Above mentioned information creates conditions to think about error prevention. P. Croskerry, D. Sinclair (2001) says that the „science of error prevention“ has been deemed a new, yet important topic in medicine. One of the most important causes of medical error can be called as wrong uses of medical devices and/or disfunction of medical devices. It is very important to reduce possible medical devices disfunctions which can lead to patient injury or death. Responsible behavior requires medical software quality and reliability assurance from the developing organizations and helps to ensure social responsibility in hospital governance, which is mentioned as a “new paradigm of hospital governance” (Brandao, Rego, Duarte, Nunes, 2013). Importance of this new parading shows a lot of articles, written by Keyvanara, Sajadi (2015), Liu, Shi, Pong, Chen (2016), Hsieh, Chiu, Hsieh, Ho, Chen, Chang (2016), Iyngkaran, Beneby (2015). Social entrepreneurship, analyzed by Roper, Cheney (2001), Hoogendoorn, Pennings, Thurik (2010), Austin, Stevenson, Wei-Skillern (2006), Laspogata, Gail, Cotton, Matya (2003), is one of the biggest challenges for the medical software manufacturers.

Companies that develop, manufacture, and market devices and products used to treat or diagnose disease and injury are facing a growing emphasis on creating ones that provide benefits from a total health economic point of view. This trend, along with slowing growth in developed countries and rapid growth in emerging markets, requires leaders who are market savvy and understand how to drive innovation, reduce costs, and provide improved clinical benefit (Korn Ferry, Medical Devices). “If a medical imaging device malfunctions due to improper servicing, a diagnosis could be missed, care could be delayed, or the patient could be severely injured or even killed” says *Patrick Hope (The executive director of the Medical Imaging & Technology Alliance (MITA), 2016, 7 November)* in the article “FDA Must Regulate the Servicing of Medical Imaging Devices to Ensure Patient Safety”.

Defective medical device statistics, mentioned below, justify the practical dimension of the issue (data from Rosenfeld: Injury Lawyers):

- In 2008, there were only 18 high risk medical devices recalled by the FDA.
- This number climbed to 31 the following year and has continued to grow in every subsequent year to date.
- In 2013, 63 high risk devices were recalled by the FDA— which represents an alarming increase of 350% compared to only five years prior.
- As of August 30, 2014, 42 medical devices have been recalled since the beginning of the year.
- In the period of 2008-2011, 45% of the devices recalled were pulled from the market due to a manufacturing defect.
- 29% of the recalled devices malfunctioned during use or failed to provide intended results.
- 11% of the medical devices recalled during this period were found to be contaminated in some way.
- The 510(k) program is an approval system that allows the manufacturers of medical devices to bring products to market without first performing clinical trials to ensure product safety and reliability. Manufacturers must only proof that the device is similar to existing devices on the market in order to gain approval through this system.
- 71% of high risk devices that have gained approval through the 510(k) program were later recalled.
- Revisions have been made to this approval process in 2013 in hopes that stricter standards will reduce the number of harmful products allowed to make it to market.

Software developing companies does not have knowledges about the conditions, which can assure medical software confidence before the release to the market. Even more, no one insurance company in Lithuania does not offer insurance for patient injury cases. Such situations stops entrepreneur involvement in the medical software creating area.

“Softneta” case study analysis scheme for searching rationale management decisions for sustainable development is presented below (Fig.1):

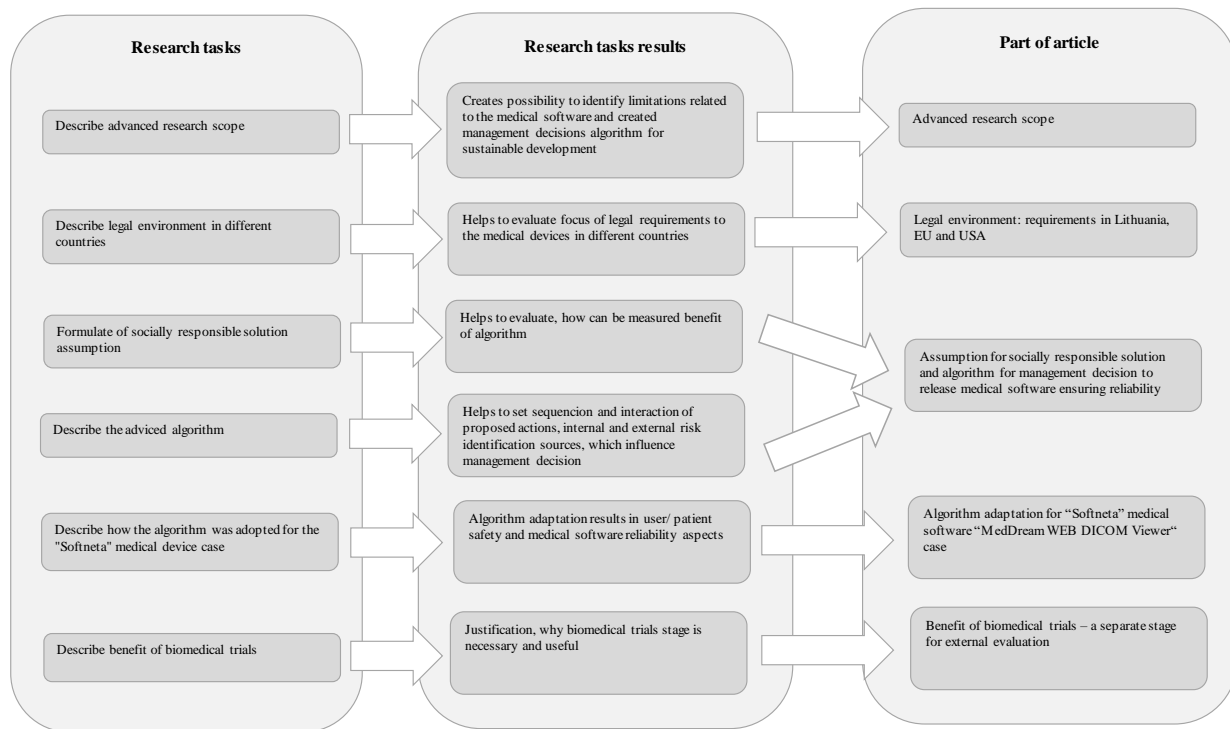


Fig. 1. "Softneta" case study analysis scheme

Source: Authors

2. Advanced research scope

Advanced research scope gives more detailed information about the medical software:

- **Definition and description of device or product, and intended use.** **MedDream WEB DICOM Viewer** is a Flash/HTML based package for PACS server which is designed to aid professionals in everyday's decision making process, connecting all the medical data into a unified and fast performing network. MedDream ensures a fast and reliable way to search, present and analyze the medical data (images and video files) on various devices: computers, smart phones, tablets (near future) and so forth. The system consists of hardware (eg., a network switch, controller) and server / client software (eg., as the final decision) for the transfer of image data from a variety of video / audio and video devices (eg. endoscopic camera, an ultrasound imaging system, radiography digital video system) to standard devices (eg., monitor, personal computer [PC]). Standalone software is considered to be an active medical device, therefore MedDream WEB DICOM Viewer is considered to be an active medical device. MedDream WEB DICOM Viewer was created to use it for medical devices images management. Indications for Use: MedDream is as software medical imaging system used to receive DICOM images, scheduling information and textual reports, organize and store them in an internal format, and to make that information available across a network via web and customizes user interfaces. Software is intended for use as a diagnostic, review and analysis tool by trained professionals such as radiologists, physicians, clinicians. Contraindications: The MedDream is not intended for the acquisition of mammographic image data and is meant to be used by qualified medical personnel only who are qualified to create and diagnose medical image data
- **GMDN Code:** Medical image management system: A computerized system designed to electronically receive, collect, store, and display a broad range of medical imaging/video data, including patient demographics, and to distribute the data within and between healthcare facilities to facilitate data organization, reporting, and sharing (e.g., teaching). The system consists of combined hardware (e.g.,

network switch, controller) and server/client software (e.g., as a turnkey solution) intended to relay image data from a broad range of imaging/audiovisual devices (e.g., endoscopic camera, ultrasound imaging system, radiography digital imaging system) to off-the-shelf devices [e.g., monitors, personal computers (PC's)].

- **FDA ID Number:** 892.2050. Radiology devices: Diagnostic devices: Picture archiving and communications system.
- **Category, classification and classification rationale:** Classification is carried out according to the requirements of Annex IX of directive 93/42/EEC and guidelines set in MEDDEV 2.4/1 Rev.9. Guidance document MEDDEV 2.1/6 is taken as a reference as it provides guidelines on the qualification and classification of stand-alone software used in healthcare within the regulatory framework of medical devices. According to the intended use of the device, MedDream is a stand-alone software that is specifically intended to be used for diagnostic purposes by viewing, archiving and transmitting of medical images. As it is not only suited for archiving or storage of data, it falls within the definition of an active medical device for diagnosis. MEDDEV 2.1/6 Annex 1 c1.4) links to the Manual on Borderline and Classification in the Community Regulatory Framework for Medical Devices, as it addresses the issue of PACS software systems. MedDream has no post-processing functions, as well as no control of image acquisition. Also it doesn't drive any other medical device, nor influence the use of a medical image source device, so implementing rule 2.3 "*Software, which drives a device or influences the use of a device, falls automatically in the same class.*" is not applicable and standalone software could be classified in its own right. MedDream allow direct diagnosis from image, also can apply multi-planar reconstruction for the better diagnosis. Based on the above mentioned considerations, Rule 10 could be appropriate and MedDream is classified as a Class IIa active medical device.

Limitations related to the medical software and created management decisions algorithm for sustainable development are mentioned below. Algorithm is applicable only for medical software, which is/has:

- classified not risky as IIa class.
- recognized as "moderate" managing level.
- no tangible product of expression;
- not required of any material;
- an exception on requirements for sterile medical devices/ this requirement is not applicable. so there is no risk to mix sterile and non-sterile products.
- integrated into the devices, which are not intended to give medication to the patients.
- no components and devices to which software is integrated, can't be treated as pharmaceuticals (also are not intended to give medication to the patients).

3. Legal environment: requirement in Lithuania, EU and USA

In general, existing regulations address public health risks of medical software. However, the current application of regulations and controls may not always translate or address the unique public health risks posed by Software as a Medical Device nor assure an appropriate balance between patient/consumer protection and promotion of public health by facilitating innovation (White Paper "Software Development for Medical Devices"). Some regulators have taken individual approaches to assure safety, effectiveness, and performance of Software as a Medical Device. Such approaches have common public health goals. The objective of this effort is to promote consistent expectations for Software as a Medical Device and to provide an optimal level of patient safety while fostering innovation and ensuring patients and providers have continued access to advances in healthcare technology. Medical software fall under regulatory scrutiny. Two prominent regulatory bodies include the FDA for medical device products marketed in the U.S., and the European Medical Device Directive for medical device products marketed in the European Union. Lithuania has also very strictly requirements to the medical devices.

The U.S. Code of Federal Regulations (CFR), including 21 CFR Part 11, Electronic Records and Electronic Signatures and 21 CFR Part 820 Quality System (QS) Regulations (as well as ISO 13485 specifications) defines a number of practices and processes which must apply to the development of software that acts as a component of a medical device or is used to aid in the production or manufacturing of a device. The Medical Device Directive (MDD) is a harmonized European standard which protects against the risks associated with the design, manufacturing and packaging of medical devices. Compliance with the requirements of the Medical Devices Directive is declared by placing the CE marking on the product, and supplying the device with a Declaration of Conformity. Conformity requires a series of assessments and examinations of the quality system and examination of the product type and design dossier relating to the product. Lithuania took over the part of the EU requirements, creates additional requirements, especially in field of biomedical research. It is very important to know, that medical software, which is not directly integrated in medical devices (stand-alone medical software), but is treated as “medical device” according to the Medical Device Directive (MDD), should be verified by external users by implementing biomedical trials. In addition to market-specific regulatory requirements such as the FDA 21 CFR 820 and the European Union Medical Device Directive, ISO 13485 provides an overarching ISO standard for quality management systems. Likewise, ISO 14971 focuses on risk management systems, IEC 62366 focuses on usability engineering to medical devices, IEC 62304 focuses on medical device software life-cycle processes. The main legal requirements in different countries are presented in the Table 1.

Table 1. The main legal requirement for medical devices

Lithuania	EU	USA
<ol style="list-style-type: none"> 1. Lithuanian medical norm MN 4:2009 “Technical Regulation on Medical Device Safety” 2. Biomedical Research Ethics Law 3. Procedure of the medical device installation, use and maintenance 	<ol style="list-style-type: none"> 1. MDD 93/42/EEC / ENTR/F/3/PBE/D(2009)19003. European Council Directive concerning medical devices. Interpretative document on the commission’s services: Implementation of directive 2007/47/EC amending directives 90/385/EEC, 93/42/EEC and 98/8/EC. 2. Version 1.17 (09-2015). Manual on Borderline and Classification in the Community Regulatory Framework for Medical Devices. 3. MEDDEV 2.1/5. Medical devices with a measuring function 4. MEDDEV 2.1/6. Qualification and Classification of stand-alone software. 5. MEDDEV 2.2/3 Rev3. “Use-by” date 6. MEDDEV 2.4/1 Rev9. Classification of medical devices. 7. MEDDEV 2.7.1/Rev4. Clinical evaluation: a guide for manufacturers and notified bodies. 	<ol style="list-style-type: none"> 1. U.S. FDA Medical Device Regulation: 21 C.F.R. Part 820 (Quality System regulation). 2. U.S. FDA Medical Device Regulation: 21 C.F.R. Part 801 et seq. (Labeling) 3. U.S. FDA MAF Regulation: 21 C.F.R. section 814.9. (Medical Device Master File) 4. U.S. FDA 510(k) Regulation: 21 C.F.R. section 814.9. (Premarket approval of medical devices) 5. Overview of Regulatory Requirements: Medical Devices 6. Software related documentation 7. General Principles of Software Validation; Final Guidance for Industry and FDA Staff 8. FDA guidelines to User Manual

	<p>8. MEDDEV 2.7/4. Guidelines on clinical investigation: a guide for manufacturers and notified bodies.</p> <p>9. MEDDEV 2.12/1 Rev 8. Guidelines on a medical devices vigilance system</p> <p>10. MEDDEV 2.12/2 Rev2. Post market clinical follow-up studies</p> <p>11. DSVG 00. Guidance on the vigilance system for CE-marked medical devices</p> <p>12. GHTF/SG3/N15R8. Implementation of risk management principles and activities within a quality management system</p> <p>13. GHTF/SG5/N4:2010. Post-Market Clinical Follow-Up Studies</p> <p>14. ENTR/F/3/PBE/pdw D(2009)27251. Interpretation of the relation between the revised directive 93/42/EEC concerning medical devices and directive 89/686/EEC on personal protective equipment</p> <p>15. ENTR/F/3/PBE/ D(2009)19003. Implementation of directive 2007/47/EC amending directives 90/385/EEC, 93/42/EEC and 98/8/EC</p>	
ISO 13485 Medical devices - Quality management systems - Requirements for regulatory purposes		
IEC 62304 Medical device software - Software life-cycle processes		
EN 62304 Medical devices - Application of usability engineering to medical devices		
ISO 14971 Medical devices – Application of risk management to medical devices		

Source: Authors

Lithuanian legal requirements highlights reliability based on biomedical researches, EU legal requirements highlights reliability based on risk management and clinical evaluation and USA legal requirements highlights reliability based on internal verification and validation, risk management. White Paper “Software Development for Medical Devices” reviews some of the key challenges facing the medical device industry. One of the mentioned challenges is “managing risk and reducing recalls”. Global software development solutions (simplified electronic tracking of requirements, risks and mitigations with relationships and dependencies; automatically compute Risk Priority Number (RPN); automated support for V-Model with named relationships between requirements, design, and software assets and their associated verification and validation assets) creates benefits: reduced risk, improving productivity while maintaining compliance and managing risk (White Paper “Software Development for Medical Devices”). Not enough rationale management decisions to release medical software leads to recalls.

Stericycle ExpertSOLUTIONS track the latest recall trends across industries. Since 2012, 783,000 medical devices have been recalled due to software issues across 280 events. Not only has new technology caused an increase in recalls, these recalls have become much more complex. Based on the Stericycle ExpertSOLUTIONS Q3 Index

Report, 28 percent of medical device companies experienced more than one recall, and one company had 23 recalls during the third quarter of 2015 alone (data from Swiss Agency for Therapeutic Products. Medical devices – List of recalls and other field safety corrective actions (FSCA)).

Swiss Agency for Therapeutic Products published list of recalls and other field safety corrective actions (FSCA) from 2016 year. 2 of 57 cases is related with medical software:

- Telemis-Medical Software Version: 4.60, 4.70. MD: Picture archiving and communication system. Problem description: In some rare circumstances, there could be a difference between measure value displayed in the viewer and the one stored internally (the stored value is visible in the measure manager window (Urgent – Field Safety Notice Telemis-Medical Software FSCA 20369).
- CONTOUR DIABETES App Software Version: 1.0.5 and lower. MD: Data management system, patient. Problem description: In very rare cases, some of the data stored in the CONTOUR CLOUD could be incomplete (Urgent field safety notice „Conour TM Diabetes APP and Contour Cloud Synchronization Customer Email“).

4. Assumption for socially responsible solution and algorithm for management decision to release medical software ensuring reliability

Decision to release medical software should be made when manufacturer can assure reliability. Reliability can be translated in to the measuring units and could have mathematical expression, further mentioned as risk/benefit calculation, as shown below:

$$Result = \left(\frac{uc}{clc*rc*cos} \right) * 100\%, \text{ where}$$

uc – user count (further medical software version user count or planned medical software user count)

clc – count of code lines (programinės įrangos eilučių skaičius)

rc – count of risks (total count of residual risks)

cos – coeficien), which is classified according to the overall residual risk estimate.

If the risk/benefit value (in percent) is less than 1 (one), considered that the software benefits outweigh the risks that may be encountered while using the software. If the software utility is equal to the risk (the risk-benefit ratio as a percentage value is equal to 1 (one) or less than the potential risks (that is greater than 1), then the version of the software can't be released to the market.

Clinical evaluation (as presented in the Figure 2), lasting during the whole design and development process, helps to identify critical issues for potential risk.

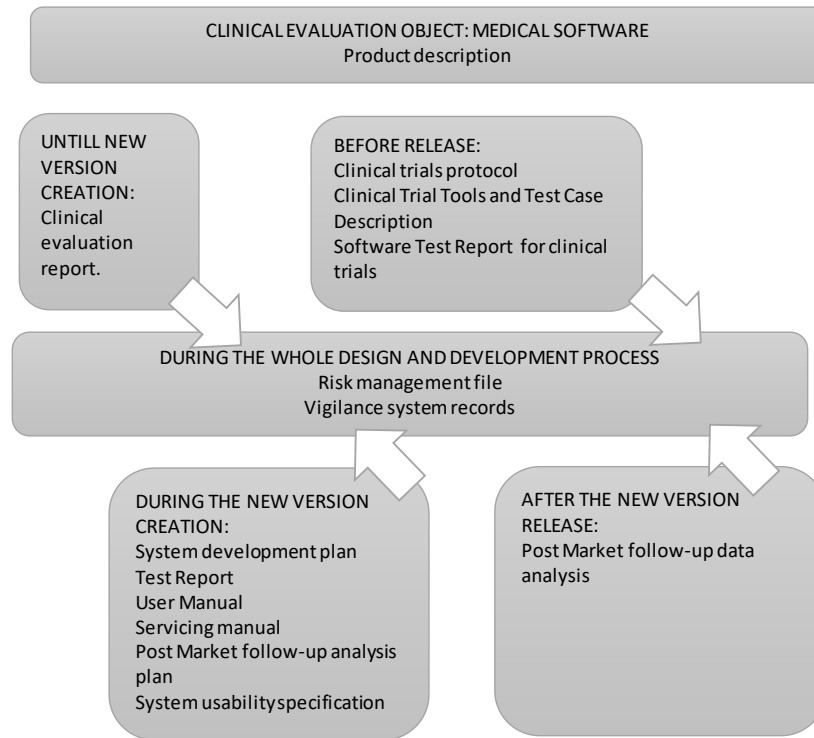


Fig 2. Clinical evaluation during the whole design and development process
Source: Authors

This picture presents internal and external data sources, which can help to identify the new potential risk (or eliminate/ reduce risk occurrence probability). Each new risk (or new risk source) should be estimated according to the initial risk evaluating method. Below presented algorithm (picture 3) shows the main stages, where risk can be identified. To ensure medical software reliability no one of the stages can be missed.

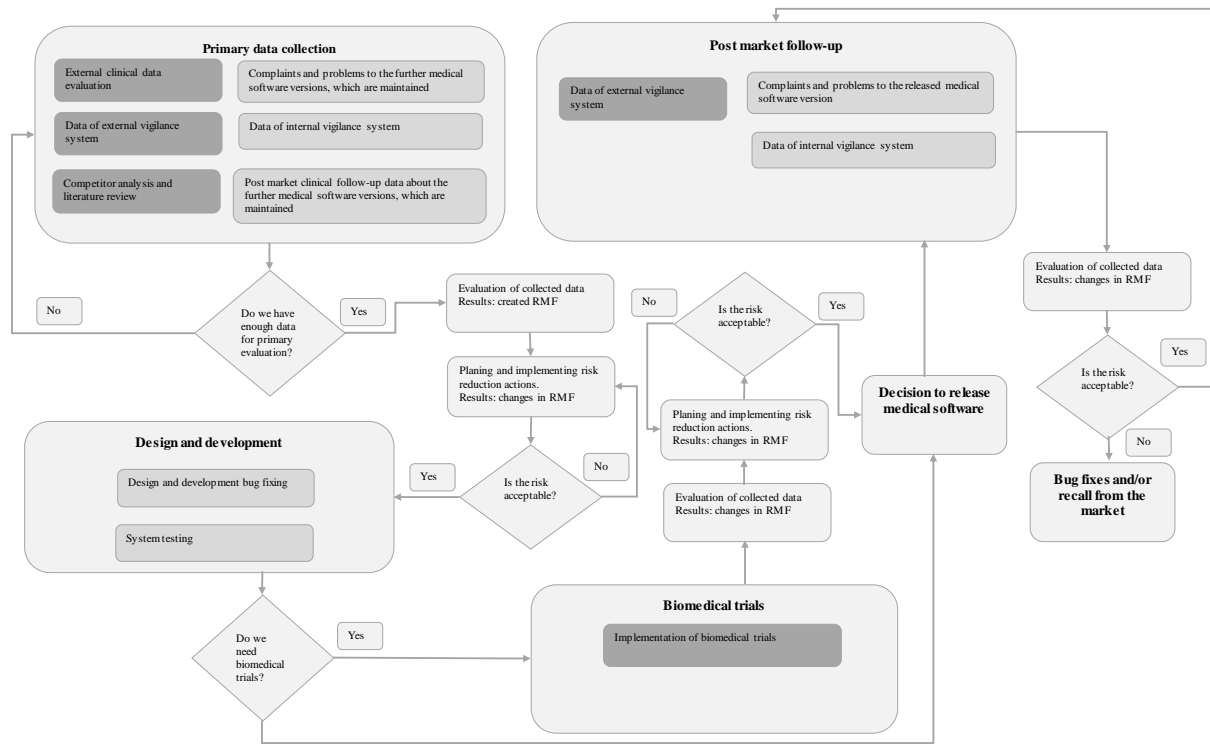


Fig 3. Algorithm for management decision to release medical software ensuring reliability
Source: Authors

Above (in Figure 3) it is presented algorithm used by “Softneta” aiming to ensure the possible lowest residual risk results.

5. Algorithm adaptation for “Softneta” medical software “MedDream WEB DICOM Viewer” case

Risk assessment results, based on real “Softneta” medical software data, presented in the table below (Table 2).

Table 2. “Softneta” medical software risk assessment results

Actions	Risk data sources	New risk, identified during the implemented actions, %	Reduced risk during primary data collection, %	Reduced risk during design and development, %	Reduced risk during biomedical trials, %	Possibility to reduce risk during the post market follow-up, %
Actions before decision making						
Primary data collection	External clinical data evaluation	0	-	-	-	
	Data of external vigilance system	2	2	-	-	
	Competitor analysis and literature review	3	2	-	-	
	Complaints and problems to the further medical software versions, which are maintained	21	3	13	-	
	Data of internal vigilance system	0	-	-	-	
	Post market clinical follow-up data about the further medical software version, which are maintained	4	3	-	-	
	Total, %	30	10	13	0	
Design and development	Design and development, bug fixing	38	-	32	-	
	System testing	12	-	12	-	
	Total, %	50	0	44	0	
Biomedical trials	Implementation of biomedical trials	10	-	-	9,5	
	Total, %	10	0	0	9,5	
Total, %		90	10	57	9,5	
76,5						
Actions after decision to release software						
Post market follow-up: possible data, which will be collected after software release to the market	Data of external vigilance system	1	-	-	-	
	Complaints and problems to the released medical software version	9	-	-	-	5
	Data of internal vigilance system	0	-	-	-	
	Total, %	10	0	0	0	5
5						
Results from the actions before decision making and actions after decision to release software						
Total, %		100	10	57	9,5	5
81,5						

Source: Authors

As shown in the table 2, decision to release medical software to the market should be made before post market follow-up. It means, that possible risks may arise after the release. Implemented actions before the decision to release medical software to the market ensure low possibility to identify many risks during the post market follow-up period. Previous „Softneta“ case studies shows, that new arised risk is not exceed 7 percent. In this case study foreseen 3 percent inaccuracy leads to the 10 percent possible risk, identified during the post market follow-up period. Case study results shows, that decision to release medical software to the market were made when 76,5 percent risk (from the 90 percent identified risk) (or 85 percent from 100 percent identified risk (if all risk, identified during the actions before decision making, equals 100 percent)) cases were solved. Not eliminated risk is treated as known bugs and would be given to the users as a part of IFU (Instructions for users).

Calculated risk/benefit results by release the medical software were 0,00002. It means, that the software benefits outweigh the risks that may be encountered while using the software. This result shows probability to arise problem/complain in 2 of 100 000 cases (or 1 of 50 000 cases). Risk, related to software functions, which can lead to injury, were eliminated. According to the algorithm, the new risk (10 percent) can arise during the post market

follow-up period. If the new risk would be identified, the worst risk/benefit result can reduce risk/benefit results 10 percent. In such case risk/benefit results would be 0,000022 (probability to arise problem/complain in 22 of 1 000 000 cases (1 of 45 455 cases). In “Softneta” case this result assure reliability of the medical software (number of users does not exceed 100 000). Other organizations, working according to the presented algorithm, should interpret results in their context and have justification for the made decision to release medical software to the market. One inexperienced injury can be evaluated using the data from insurance policy: 1 000 000 EUR for each and every claim, including cost and expenses. The Table 3, presented below, shows the benefits of applying the algorithm.

Table 3. Benefits of applying the algorithm

Algorithm actions	New risk, identified during the implemented actions, %	Reduced risk during primary data collection, %	Reduced risk during design and development, %	Reduced risk during biomedical trials, %	Possibility to reduce risk during the post market follow-up, %	Probability to arise problems/injury before the implemented actions	Probability to arise problems/injury after the implemented actions
Primary data collection	30	10	13	0		x	x
Design and development	50	0	44	0		1 of 30 303 cases	1 of 45 455 cases
Biomedical trials	10	0	0	9,5		1 of 45 455 cases	1 of 50 000 cases
Post market follow-up	10	0	0	0	5	1 of 50 000 cases	1 of 49 751 cases

Source: Authors

Risk/benefit score can be calculated having primary information not only about risk, but also about the count of code lines. This data can be firstly used in stage of design and development. Each algorithm action helps to reduce probability to arise problems/injury and shows possible result if any actions could be not implemented.

6. Benefit of biomedical trials – a separate stage for external evaluation

In order to know biomedical trials impact to the management decision to release medical software to the market, the biomedical trials were implemented. Data, presented in table No. 3, were obtained by in cooperation with Vilnius Santariskes clinics during the biomedical research for Medical Software product Meddream Web DICOM Viewer. The sample size was determined according to the respondent calculator which was made on the basis of T. Yamane, V.A Jadov and research organization “Factus” experience. The sample size (Table 4) is presented below.

Table 4. The sample size for biomedical trials

Investigation per year, units: X-rays	50.000	Investigation per year, units: KT	30.000	Investigation per year, units: MRT	5.000
Probability, %	95	Probability, %	95	Probability, %	95
Inaccuracy, %	10	Inaccuracy, %	10	Inaccuracy, %	10
Sample size, units	96	Sample size, units	96	Sample size, units	94
Total sample size, units	286				

Source: Authors

This biomedical evaluation were implemented for Medical Software product Meddream Web DICOM Viewer for the purpose to ensure maximum patient safety using this software. The main tasks of biomedical evaluation:

- To verify that the fully integrated and final system to be delivered meets the specification and its purpose;
- To get a confirmation from the user that system is accepted and solves those business problems for which it was designed to automate;
- Performance: if Meddream Viewer achieves the performances intended by Softneta UAB;
- Safety: if undesirable side-effects, under normal conditions of use, are acceptable when weighed against the benefits to the patient.
- To determine any undesirable side effects and to make sure that the side effects by normal usage environment are acceptable risks (weighed against the intended operation of the medical device).

Data, presented in table 4, leads to thinking, that biomedical trials is very important actions, which can assure better reliability of medical software.

Conclusions

Manufacturers of medical devices assume responsibility for the correct functioning of medical devices and medical software manufacturer should assume responsibility for medical decisions making and medical decision influence on patient. This responsibility is related not only to the legal and financial risk, but also to the socially responsible business commitments.

Software developing companies does not have knowledges about the conditions, which can assure medical software confidence before the release to the market. Even more, no one insurance company in Lithuania does not offer insurance for patient injury cases. Such situations stops entrepreneur involvement in the medical software creating area.

“Softneta” present their social responsibility by creating rationale management decisions algorithm for sustainable development. This algorithm, created according to the medical devices related legal requirements, standards and good design and development practices, gives answer to the question “when the medical software ensures enough reliability and can be released to the market?” and eliminate restrictions, therefore can be used by other medical software creating organizations.

The current application of regulations and controls may not always translate or address the unique public health risks posed by Software as a Medical Device nor assure an appropriate balance between patient/consumer protection and promotion of public health by facilitating innovation.

Case study is applied to the stand-alone medical device: software MedDream WEB DICOM Viewer, which is classified as a Class IIa active medical device and for the safety creation and maintenance conditions, also for the selling conditions should comply Lithuanian, EU and USA (FDA) legal requirements.

Lithuanian legal requirements highlights reliability based on biomedical researches, EU legal requirements highlights reliability based on risk management and clinical evaluation and USA legal requirements highlights reliability based on internal verification and validation, risk management. All this approach are integrated by creating algorithm for management decisions for sustainable development (for the decision to release medical software to the market).

Algorithm is applicable only for medical software, which is/has classified not risky as IIa class; recognized as "moderate" managing level; no tangible product of expression; not required of any material; an exception on requirements for sterile medical devices/ this requirement is not applicable. so there is no risk to mix sterile and non-sterile products; integrated into the devices, which are not intended to give medication to the patients; no components and devices to which software is integrated, can't be treated as pharmaceuticals (also are not intended to give medication to the patients).

Decision to release medical software should be made when manufacturer can assure reliability. Reliability can be translated in to the measuring units and could have mathematical expression, which advices authors.

Medical software reliability depends on risk management results, using clinical evaluation data during the whole design and development process.

Algorithm for management decision to release medical software ensuring reliability were used by "Softneta" in order to ensure the possible lowest residual risk results.

Case study results shows, that decision to release medical software to the market were made when 76,5 percent risk (from the 90 percent identified risk) (or 85 percent from 100 percent identified risk (if all risk, identified during the actions before decision making, equals 100 percent)) cases were solved. Not eliminated risk is treated as known bugs and would be given to the users as a part of IFU (Instructions for users).

Calculated risk/benefit results by release the medical software were 0,00002. It means, that the software benefits outweigh the risks that may be encountered while using the software. This result shows probability to arise problem/complain in 2 of 100 000 cases (or 1 of 50 000 cases). Risk, related to software functions, which can lead to injury, were eliminated.

According to the algorithm, the new risk (10 percent) can arise during the post market follow-up period. If the new risk would be identified, the worst risk/benefit result can reduce risk/benefit results 10 percent. In such case risk/benefit results would be 0,000022 (probability to arise problem/complain in 22 of 1 000 000 cases (1 of 45 455 cases)).

By the calculating probability to arise problems/injury before and after the implemented actions algorithm action helps to reduce probability to arise problems/injury and shows possible result if any actions could be not implemented.

Biomedical trials – a separate stage for external evaluation shows that biomedical trials were very important seeking to ensure better reliability of medical software (reduced probability to arise problems/injury from 1 of 45 455 cases till 1 of 50 000 cases).

Financial benefit of biomedical trials can be calculated using data from insurance policy: 1 000 000 EUR for each and every claim, including cost and expenses.

To ensure case studies results extension for the summarized calculation about each algorithm implementation stage, the case study should be replicated to the other medical software creating organizations.

Acknowledgements

Research and publication of results was funded by JSC “Softneta”

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Laura Baronienė, Master’s degree in management at Kaunas Technology University, Economics and Management department. She is currently working as a quality manager in “Softneta” and is responsible for ensuring compliance to the Lithuanian, EU and USA (FDA) requirements for medical devices. Her research areas are quality management, management decisions, innovation management, medical device quality management.

ORCID ID: orcid.org/0000-0002-1989-8688

Researcher ID: R-2836-2016

Vytautas Žirgūtis, Phd is lecturer at Vytautas Magnus University, Economics and Management department. His research areas are strategic management, quality management and stakeholders’ management.

ORCID ID: orcid.org/0000-0003-1893-1113

Researcher ID: R-3706-2016





ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

THE MANAGEMENT BY OBJECTIVES IN BANKS: THE POLISH CASE

Jerzy Kaźmierczyk¹, Mateusz Aptacy²

¹ Poznan University of Economics and Business, address: al. Niepodległości 10, 61-875 Poznań, Poland,
Tyumen State University, address: 6 Volodarskogo St., 625003 Tyumen, Russia

² Poznan University of Economics and Business, address: al. Niepodległości 10, 61-875 Poznań, Poland,

E-mails:¹ jerzy.kazmierczyk@ue.poznan.pl; ² mateusz.aptacy@gmail.com.

Received 15 May 2016; accepted 25 July 2016

Abstract. This paper examines the occurrence of Management by Objectives system in banks in Poland. According to the theory, MBO should be applied to the entire organization; however, in practice MBO is often used only in selected parts of the organization. The purpose of this study was to investigate the segmentation of MBO in banks, according to the job position, job seniority, educational and gender aspects individually. Firstly, grounded on the literature, this article describes the characteristics of MBO and the rewarding plans for the achievement of objectives. The survey among bank employees helped to accomplish the research aim undertaken in this article. Based on conducted research, empirical subsection shows the results of the study in comparison to the analysis made by other authors. The results revealed the diversity in using MBO in banks in Poland. Furthermore, showed that male employees in banks are covered by the Management by Objectives system more frequently than females, and that bank staff with tertiary education are subject to the Management by Objectives more often than employees with secondary education.

Keywords: HRM, management by objectives, banks, Poland

Reference to this paper should be made as follows: Kaźmierczyk, J., Aptacy, M., 2016. The management by objectives in banks; the Polish case, *Entrepreneurship and Sustainability Issues* 4(2): 146-158

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(3\)](http://dx.doi.org/10.9770/jesi.2016.4.2(3))

JEL Classifications: J2, M5, M54

1. Introduction

According to Olexandrivna, modern enterprises seek a balance for the functioning of all of their subsystems. This harmony has a significant influence on the strategic development of the whole organization, which in turn may result in its competitive advantage (Olexandrivna 2016, p. 63). In the contemporary scientific literature various ways to gain competitive advantage are discussed and suggested (e.g. Fuschì, Tvaronavičienė 2014; Belás et. al. 2016; Razminienė et al. 2016; Tvaronavičienė, Černevičiūtė 2015). One of the ways to achieve this balance could be the Management by Objectives (MBO). Unfortunately, in practice MBO frequently deviates significantly from

the foundations laid by its author, P.F. Drucker. MBO has been studied for a long time, as shown by the literature review. What is missing is the current research taking into account the changing conditioning (Voronov et al., 2014, pp. 29-30; Romashkina and Andrianova, 2007, p. 50; Bondaryeva et al., 2015, pp. 236-237; Wyrwa 2015, p. 127). MBO is relatively new in Poland and there is not enough research on MBO in Poland. Theory assumes that MBO should be applied to the entire organization; however, practice has shown that MBO in Poland is often used only in selected parts of the organization.

This study focuses on the employment in banks in Poland. The banking sector is the biggest and best-developed segment of the Polish financial system. It is characterized by rapid development on the domestic market and the use of a variety of interesting human resources management tools, including MBO (Każmierczyk and Świt 2011, p. 299). This is due to the large share of foreign capital in Polish banking sector. Polish banks make successful use of a range of solutions adopted in Western Europe. Moreover, banks employ large staffs, which allows one to make a reliable assessment of the submitted theses.

The main aim of this paper is to present the concept of Management by Objectives and then to analyse and evaluate its occurrence in banks in Poland. This paper propounds the following theses:

1. There is segmentation of banks in Poland according to the use of the Management by Objectives system.
2. The Management by Objectives in banks more often involves the managerial staff than non-managerial employees.
3. In banks, the Management by Objectives is more common among employees with longer job seniority in the current workplace than among people at the beginning of their employment in a particular unit.
4. Bank employees with tertiary education are subject to the Management by Objectives more frequently than employees with secondary education.
5. Male employees in banks are part of the by the Management by Objectives system more frequently than females.

To accomplish the research aim undertaken in this paper, the author used specialist literature both in Polish and in English (The ACM Digital Library, BazEkon, EBSCO, Emerald, ProQuest). A survey was also used which examined nearly 2,000 bank employees.

This article consists of introduction, two theoretical subsections characterizing MBO and the rewarding plans for the achievement of objectives, the description of the research method and the empirical data, the results of the empirical study and conclusions.

2. Management by Objectives as concept

The Management by Objectives, also described in the specialist literature as the Management by Objectives and Self-control, was first described by P.F. Drucker in the book *The Practice of Management*. This concept was introduced into the practice of management in the 1960s. Initially, it was criticized due to possible negative effects that it could bring (f.ex. adverse influence on employees' creativity). It also met with disapproval because of managers' who, following the latest trends, introduced it blindly without full understanding of the basic conditions required for its application (Fulk, Bell and Bodie 2011, p. 18).

According to X. Liu definition (2010, p. 219), 'MBO is a suit of systematization democratic management style which higher-level and lower-level managers and employees in a organization together set down the common organization goal, form one goal system and specify and outspread to every department, every administrative level, every employee in organization and ties nearly up with their duty and production of every department, every administrative level, every employee within organization, definitely prescribe their consecration and encouragement.' The Management by Objectives is based on bilateral communication between the manager and a subordinate employee. They are both engaged in the joint process of setting objectives, which

channel their collective efforts and serve as the basis for assessment. It was assumed that all employees engaged in the process of determining objectives will put more effort into their realization, which will in turn contribute to a higher probability of their accomplishment. These activities have a stimulating effect on the employees' motivation and oblige them to take responsibility for the realization of tasks in the setting of which they have participated himself. Moreover, R. Čiutienė and P. Petrauskas (2012, p. 1560) noticed that apart from setting the goals, MBO should also 'monitoring, motivating, control and awarding for each person and all organization'. Therefore, it could be an overall system conducive to the performance of the organization.

It is crucial that every manager should have the information he needs to evaluate his efficiency and that he should have the information early enough. That allows him to make changes necessary for the achievement of the desired objectives and for the functioning of the organization as a whole. It is fundamental that this information should reach the manager directly, excluding his superior, to avoid it becoming an element of Top-Down Management. Moreover, at a time when the access to databases and their analyses is practically unlimited, superiors should resist the temptation to exercise regular control over their subordinates, because by doing so they may significantly undermine employees' independence, which may result in their decreased efficiency. Obviously, all methods that the organization considers as undesirable, unethical or unprofessional, should be clearly specified. Managers must be aware which practices are considered reprehensible. For the Management by Objectives to function efficiently, managers ought to be independent during the decision process, without fracturing the system's structures (Drucker 1994, p. 151).

3. The rewarding plan for the achievement of objectives

The benefits company gains from the implementation of MBO are not limited only to the increased productivity but also cause the increase in employees' motivation and job satisfaction. The Management by Objectives in principle helps the workers become a real team focused on both individual and organizational goals. Many of them show interest in improving professional skills, some even undertake specialist training. The more the employees are willing to work in groups, the greater the benefits for the company as they learn their skills from each other (Luft 2014, p. 25).

It must be stressed that the Management by Objectives is effective only when it is supported by the existing motivation system. The bonus system cannot function as an autonomous incentive scheme. For the MBO system to have a proper effect on motivation, it should work separately from the existing bonus scheme. Gratifications ought to be awarded, as it were, during periodic reviews. Furthermore, when the Management by Objectives system does not bring the expected results, then an additional bonus system may not improve its effectiveness. All benefits should derive from the good results produced by the Management by Objectives, the only system solely responsible for awarding the employees. Any use of discretionary factors in the evaluation and awarding of the employees is unacceptable. It may lead to pathology in the functioning of the system (Reinfuss 2009, p. 156).

In the MBO system, excessive concentration on the tangible measurable goals and the underestimation of the abstract ones can become an obstacle to the evaluation of an employee's performance. This problem results from the SMART goal-setting criteria, according to which every objective should be e.g. measurable. In practise there are many situations, when the parameters to be achieved are difficult to determine in advance. It can be problematic to assess the quality of the transactions executed by a company, because such values as the level of trust between the parties of a contract or the employees' influence on the atmosphere in the workplace are hard to measure (Bieniok 2001, p. 171; Barska and Lychmus 2007, pp. 39-40). The Management by Objectives makes managers concentrate primarily on their own, current objectives, which directly affect their results (and consequently, the corresponding bonuses) instead of the prospective goals of the whole organization. They avoid taking a firm and clear stance on current, unpredictable issues as any wrong decision may adversely influence their bonuses and any right decision

will not be awarded anyway. Thus, MBO may exonerate the employees from caring for the condition of the overall organization (Blikle 2014, p. 112).

4. The main theses of the Management by Objectives system

This paper propounds the following theses:

1. There is segmentation of banks in Poland according to the use of the Management by Objectives system.
2. The Management by Objectives in banks more often involves the managerial staff than non-managerial employees.
3. In banks, the Management by Objectives is more common among employees with longer job seniority in the current workplace than among people at the beginning of their employment in a particular unit.
4. Bank employees with tertiary education are subject to the Management by Objectives more frequently than employees with secondary education.
5. Male employees in banks are part of the by the Management by Objectives system more frequently than females.

According to G.H. Graham, it is relatively rare for non-managerial employees to work under the Management by Objectives system (Graham 1968, p. 300). This is because they have limited access to current information on the organization's condition and therefore their influence on the formulation of its objectives is also very limited. On the other hand, employees in managerial positions are included in MBO more frequently. It could be due to their greater impact on the organization's efficiency and greater responsibility for its functioning. Considering MBO's differentiation with regard to particular working positions, the following thesis was posed: the Management by Objectives in banks includes the managerial staff more frequently than non-managerial employees.

The length of service (seniority) in an organization refers to the number of years an employee has been part of a particular company. Subordinates may understand better and have more confidence in a more experienced manager. They are more efficient and more aware of their meaning for the whole organization and consequently there are fewer failures in the process of goals achievement (Lederer and Burky 1988, p. 60). Considering the nature of employment in banks, a thesis can be propounded that the Management by Objectives is more frequent for employees with a longer seniority with a present employer than those starting their job in a particular company. In addition, an employee's work experience is likely to be correlated with his position on the organizational ladder. Persons in managerial positions are more likely to have been long-term employees, a fact which favors the use of MBO.

Although the MBO system is often assumed to cover the entire organization (Chrościcki 1999), in practice it often does not prove to be so. The level of education greatly influences the success of the use of MBO. It is argued that a better-educated manager is more likely to embrace the organization in its entirety. He also has a better understanding of the objectives of individual employees (Lederer and Burky 1988, p. 60). On the other hand, the lack of certain skills may cause serious problems with cooperation (Tosi, Rizzo and Carroll 1970, p. 74). Accordingly, it can be concluded that those working under the Management by Objectives system are better-educated and have better professional qualifications, which help them find themselves better in the MBO system. A thesis therefore was propounded that employees with tertiary education are subject to the Management by Objectives more frequently than employees with secondary education.

J. Losak (1975, p. 10-11) has noticed that males are involved in the Management by Objectives more frequently than females. The source of this inequality may be the insufficient use of females' potential and it could be connected with the glass ceiling phenomenon (Baxter and Wright, 2000, pp. 275-276; Kalinowska-Sufinowicz, 2005). Employers promote males to managerial positions more frequently even if their professional skills are approximately equal to those of female employees (Omran, Alizadeh and Esmaeeli 2015, p. 316). In consequence, despite being appropriately qualified, females tend to hold lower positions (not covered by MBO) than males.

Accordingly, a thesis was put forward that male staff in banking are covered by the Management by Objectives more frequently than female employees.

5. Methodology²

The data from the survey, which was conducted from January 2016 to April 2016, were used to test the research thesis. The “snowball” technique was used in order to collect the data³. The survey participants were invited by existing subjects. Personal contacts and individual visits to banks were used to collect the data. More than 20.000 queries were sent with a request to fill in the questionnaire via e-mail, social networking websites (such as Facebook, GoldenLine and LinkedIn) and thematic forums. Both an electronic version (<https://docs.google.com/forms/d/1fq9ZKdr8zXA7zjp8wFowBqJ6ciT4nSmjer598pGWbG0/viewform>) and hard copy one of the questionnaire were used in the survey.

The main survey was preceded by a two-staged pilot survey. First, the survey was conducted on a small group of target participants (180 students). The aim was to reveal any inconsistencies and to examine whether the questions were understandable. Thanks to the pilot study, the questionnaire was modified and improved. In the second stage, the target group consisted of 100 employees from the banking sector.

The questionnaires have been completed by 1.949 respondents. 29 questionnaires were rejected due to low credibility and reliability (for example, some respondents selected “0” in response to all of the closed-ended questions). As a result, the final research sample consists of 1.920 respondents (152 electronic version and 1768 hard copy). Table 1 provides more details regarding the sample structure.

Table 1. Sample structure

	Criterion	Number of individuals	Percentage
Gender	Female	1312	68.33%
	Male	473	24.64%
	No answer	135	7.03%
Education	University (major in economics)	883	45.99%
	University (other)	515	26.82%
	High school (major in economics)	270	14.06%
	High school (other)	189	9.84%
	Vocational	2	0.1%
	Elementary	2	0.1%
	No answer	59	3.1%
Occupied position	Senior managerial position	43	2.24%
	Middle-level managerial position	129	6.72%
	Lower-level managerial position	153	7.97%
	Non-managerial position	1485	77.34%
	No answer	110	5.73%
Organizational unit	Headquarters	409	21.3%
	Regional branch	416	21.66%
	Operational branch	1020	53.13%
	No answer	75	3.91%
Type of bank	Commercial bank	1342	69.90%

² The research results presented are part of a broader study (about: recruitment, forms of employment, motivation, professional education, e-learning, loyalty, stress, work efficiency, MBO, perks, mobbing, professional career, derecruitment, dismissals and outplacement), which was based on the same research method. Thus, the description of the research method is applicable also to the results of research on other aspects of HRM and other papers by Jerzy Kaźmierczyk.

³ This method does not generate high research cost. Another advantage is that it allows to reach a wider population and is relatively simple.

	Cooperative bank	481	25.05%
	No answer	97	5.05%
The equity	National	919	47.86%
	Foreign	863	44.95%
	No answer	138	7.19%
Workplace	Front office	1118	58.23%
	Back office	460	23.96%
	No answer	342	17.81%
Disability	Lack	1820	94.79%
	Slight level	12	0.63%
	Moderate level	8	0.42%
	Significant level	2	0.1%
	No answer	78	4.06%

Source: own computations based on the survey data

The composition of the research sample according to gender, type of education and type of bank corresponds to the structure of employment in the banking sector in Poland (Każmierczyk, 2011, p. 115-124). The mean age of respondents was 36.612 years. The mean work experience in banking was 12.065 years, ranging from 1 to 43 years. The mean total work experience of respondents was 14.976 years (Table 2).

Table 2. Summary statistics on age and work experience

Criterion	Minimum	Maximum	Mean	Median	Standard deviation
Age	19	64	36.612	35	9.7496
Work experience in banking	1	43	12.065	10.000	9.5799
Work experience with current employer	1	43	9.835	7.000	9.3882
Total work experience	1	45	14.976	12.000	10.2416

Source: own computations based on the survey data

The locality size criterion demonstrates that the largest group of respondents came from the localities inhabited by 50 thousand people, the fewest surveyed people coming from localities with 200-500 thousand inhabitants (Table 3).

Table 3. Summary statistics on place of residence

Size of locality	to 50 thous people	658	34.27%
	50-100 thous people	251	13.07%
	100-200 thous people	245	12.76%
	200-500 thous people	124	6.46%
	More than 500 thous people	541	28.18%
	No answer	101	5.26%

Source: own computations based on the survey data

The questionnaire consists of an introduction followed by 23 closed-ended questions and several demographic and work-related questions. The main part of the questionnaire contains questions which refer to seven important human resource management areas (recruitment, forms of employment, motivation, professional education, e-learning, loyalty, stress, work efficiency, MBO, perks, mobbing, professional career, derecruitment, dismissals and outplacement). Some of the questions were used to test the research thesis.

6. The Management by Objectives in banks in the light of empirical research⁴

The results of empirical research conducted among bank employees are presented below. The first finding of the conducted research is the difference in MBO occurrence between commercial and cooperative banks. 26.3% of all respondents working in commercial banks, stated that they are part of the Management by Objectives system, whereas in cooperative banks this proportion was only 5.8% (Table 4). The reason for such a great disparity may be the disproportionately smaller capital strength and performance of cooperative banks as compared to commercial banks (Rolski 2015, p. 256). The less wealthy cooperative banks may be characterized by the low quality of their managerial staff. It can lead to undertaking the wrong actions in the management process (The Polish Financial Supervision Authority 2015, p. 8), the use of outdated technology, low level of innovation and the lack of modernity (The Polish Bank Association 2013, p. 10).

Table 4. The Management by Objectives system according to the bank type

	Percentage	Number of responses	Chi-square	df	Significance level	Phi Yule
Commercial bank	26.3%	348	87.499	1	0.000	-0.221
Cooperative bank	5.8%	27				

Source: own computations based on survey data

In terms of the majority capital, one can observe prevalence in MBO's occurrence in banks with a majority foreign capital (28.3%) (Table 5). Such a high percentage difference can be caused by the transfer of banking knowledge and the implementation of modern standards (Rzyman *et al.* 2015). One of these standards was MBO, successfully employed in the process of human resources management in western countries (Fulk, Bell and Bodie 2011, p. 18). Only 13.5% of the banking staff with majority domestic capital are included in the MBO system. This may be due to technological deficiency or low management culture (Dąbrowska-Gruszczyńska 2013, p. 43).

Table 5. The Management by Objectives system according to capital equity

	Percentage	Number of responses	Chi-square	df	Significance level	Phi Yule
Majority domestic	13.5%	121	57.788	1	0.000	0.182
Majority foreign	28.3%	242				

Source: own computations based on survey data

The Management by Objectives is characterized by strong differentiation according to the workplace. Nearly every third respondent (32.1%) working in the back office departments confirmed the occurrence of the MBO system in his position (Table 6). In departments having direct contact with customers (the front office), 18.1% of respondents stated that they are involved in this system. This regularity corroborates the relationships described by S. Carroll, H. Tossi (1968, p. 418) and G.H. Graham (1968, p. 297). According to their analyses, the Management by Objectives occurs more frequently at higher positions in the organizational hierarchy. Knowing the characteristics of the back office employment (Muniesa *et al.* 2011, p. 1193-1195), it may be assumed that majority of senior managers' work in departments of this kind.

Table 6. The Management by Objectives system according to the workplace

	Percentage	Number of responses	Chi-square	df	Significance level	Phi Yule
Front office	18.1%	200	36.126	1	0.000	0.152
Back office	32.1%	145				

⁴ The empirical study data are presented in order of significance of the obtained results, with the results where the response differences were the greatest presented first.

Source: own computations based on survey data

Another noticeable tendency is the increase in the occurrence of the Management by Objectives in parallel with the size of the locality where the bank is located. Towns with the population of less than 50,000 and those between 50,000 and 100,000 showed the MBO share to be 7.3% and 23.3% respectively (Table 7). Among cities of 100,000-200,000 inhabitants, 25.3% of respondents declared to be covered by the Management by Objectives system. The largest MBO share was found to be in cities of 200,000-500,000 inhabitants (30.6%) or over (31.5%). The development, especially the quality development, of the main urban centres based on the generation and implementation of innovation technologies and making use of intellectual values, helps to create conditions conducive to the development of the human resource capital (Wrana 2013, p. 9). Big cities are seats of banks' headquarters and regional branches, which is a factor, favouring the employment of managers working by MBO principles.

Table 7. The Management by Objectives system according to the size of locality

	Percentage	Number of respondents	Chi-square	df	Significance level	Cramér's V
Below 50,000 inhabitants	7.3%	47	118.482	4	0.000	0.258
50,000-100,000 inhabitants	23.3%	57				
100,000-200,000 inhabitants	25.3%	62				
200,000-500,000 inhabitants	30.6%	38				
over 500,000 inhabitants	31.5%	167				

Source: own computations based on survey data

A detailed gender analysis of the respondents involved in the MBO system has shown a difference of over 10.2 percentage points between females and males. Of all male respondents, 27.4% pointed to the occurrence of MBO in their workplace, while the corresponding percentage for women was 17.2% (Table 8). The reason for such a large discrepancy is to be found in a higher number of males holding managerial positions than females (Gayle, Golan and Miller 2012, p. 831). These positions are characterized by MBO occurrence more frequently than the non-managerial ones. This proves the thesis that males working in banks are covered by the Management by Objectives system more often than females. U. Wilkesmann and C.J. Schmid (2012, p. 44-45) have come to similar conclusions in the course of their research. They also noticed that females under the MBO system usually pay greater attention to the proper performance of professional duties than males⁵.

Table 8. The Management by Objectives system according to gender

	Percentage	Number of respondents	Chi-square	df	Significance level	Phi Yule
Female	17.2%	220	22.410	1	0.000	0.113
Male	27.4%	128				

Source: own computations based on survey data

The percentage of young workers (under 35 years of age inclusive) covered by MBO equals 23.2% (Table 9). Among older employees (over 35 years of age) this proportion is 17.9%, the difference thus being 5.3 percentage points. Young workers frequently represent values which are the most required on the labour market. Therefore employers are doing their best to make high-flier subordinates emotionally attached to their companies (DeKay 2013, p. 250). For that reason, with regard to these workers employers are more willing to use a wide range of

⁵ It is therefore odd that males hold managerial positions more frequently than females. The introduction of a new regulatory framework may be the way to cure this situation. However, J. Losak (1975, p. 10) argues against the implementation of gender parities. In his opinion, employees' performance is the sole basis for their evaluation. Determined efforts at establishing a proper balance between female and male quotas in a company could prove pernicious for the whole organization.

motivational methods and instruments. It helps them establish and maintain mutual ties and retain young employees in the company (Kampioni-Zawadka 2014, p. 143).

Table 9. The Management by Objectives system according to age

	Percentage	Number of respondents	Chi-square	df	Significance level	Phi Yule
Under 35 years of age inclusive (median)	23.2%	221	8.167	1	0.004	-0.066
Over 35 years of age (median)	17.9%	165				

Source: own computations based on survey data

With regard to the criterion of education a certain asymmetry has been observed. This asymmetry relates to the level of education of employees involved in MBO. Staff with tertiary education, both graduates in Economics (24.1%) and other majors (21.4%), are largely covered by the system (Table 10). Only 11.4% of graduates of secondary schools of Economics declared to be working under MBO, whereas 13.7% of graduates of other schools confirm that. The Management by Objectives was not observed among the graduates of primary or vocational schools. On this basis, employees could be divided into two groups: those with a university diploma and those with secondary education. The difference between these groups in MBO occurrence may reach even 10%. The results prove the thesis according to which university-educated employees are more frequently covered by the Management by Objectives system than those with a secondary school diploma. This regularity finds its reflection in the relationship described by G.H. Graham's (1968, p. 298) between the acquired education and the MBO occurrence. It can be explained by the characteristics of positions which are subject to MBO. Usually, higher organizational positions require higher professional qualifications. Therefore, employers are trying to fill these vacancies with candidates with tertiary education. Such employees, even when lacking strictly economic education, have been taught to adopt an analytical approach to problem-solving (Jepsen, Troske and Coomes 2014, p. 97). In the course of their research, D. Terpstra and P. Olson (1984, p. 439) have arrived at slightly different conclusions. They have analysed the opinions of employees working under MBO. According to their results, once the Management by Objectives system has been implemented, the employees felt that the requirements regarding their professional qualifications have been relaxed.

Table 10. The Management by Objectives system according to education

	Criterion	Number of respondents	Chi-square	df	Significance level	Cramér's V
University (major in Economics)	24.1%	209	26.709	5	0.000	0.121
University (other)	21.4%	108				
High school (major in Economics)	11.4%	30				
High school (other)	13.7%	25				
Vocational	–	0				
Primary	–	0				

Source: own computations based on survey data

The relationship between an employee's seniority in the current bank and MBO occurrence is very interesting. A noticeable trend is for MBO to be applied more frequently to employees with less job experience in the current workplace than the more experienced ones. The survey showed that nearly every fourth respondent (23.5%) with up to and including 7 years' seniority with the current employer is covered by the MBO system (Table 11). Among employees with seniority of over 7 years the proportion is 17.7%, the difference between both values being 5.8 percentage points.

Table 11. The Management by Objectives system according to seniority in the current bank, in banking and in general

	Percentage	Number of respondents	Chi-square	df	Significance level	Phi Yule
Up to 7 years' seniority (inclusive) with current employer (median)	23.5%	219	9.897	1	0.002	-0.073
Over 7 years' seniority with current employer (median)	17.7%	167				
Up to 10 years' seniority in banking (inclusive) (median)	22.7%	234	6.601	1	0.010	-0.059
Over 10 years' seniority in banking (median)	17.9%	152				
Up to 12 years' combined seniority (inclusive) (median)	23.2%	215	7.746	1	0.005	-0.064
Over 12 years' combined seniority (median)	18.0%	171				

Source: own computations based on survey data

This trend was also confirmed with reference to seniority in banking. It has been observed that 22.7% of employees with up to and including 10 years' seniority in banking are covered by MBO as compared to 17.9% for those with over 10 years' seniority. As regards the criterion of combined tenure, 23.2% of employees with up to and including 12 years' seniority are involved in MBO, whereas for employees with seniority of over 12 years the proportion is 18%.

No significant disparities have been shown in the occurrence of the Management by Objectives with regard to job seniority (in the current workplace, in banking and combined). This confirms the relationship described by G.H. Graham in 1968 (p. 297), according to which employees with longer tenure in the current workplace are involved in the Management by Objectives system less frequently than employees with less job experience. This may result from the more experienced employees' lower awareness of the incentive system operating in their bank. On the other hand, the employer may be the one responsible. Human Resource departments feel obliged to inform the newly-employed staff about the motivational system adopted in the workplace, overlooking employees with longer seniority, taking their knowledge of the incentive system for granted. This is confirmed by the increased frequency of 'there is no such system' (or 'I know nothing about it') responses by the more experienced employees. Therefore, the thesis propounding the more frequent occurrence of MBO among employees with longer job seniority at the current workplace than among the less experienced ones has been disproved. However, this phenomenon requires further, broader and more detailed analysis.

The analysis of the Management by Objectives system in relation to the position held by the respondents showed it was more common among senior managers (38.1%). A correspondence has been observed between the decreasing proportion of employees involved in MBO and their position in the organizational hierarchy. Accordingly, the proportion of middle management staff covered by MBO is 24.6%, compared to 23.6% for lower-level managers and 19.7% for non-managerial staff. This trend is also confirmed by the specialist literature. Unfortunately, the statistical significance of this analysis (15%) does not meet the statistical significance level of 5% determined for social sciences (Hansen, Lunde and Nason 2005, p. 11). Additionally, it was observed that the occurrence of sales promotion systems decreases with positions at the top of the hierarchy. Lower-level managers (63.5%) and non-management employees (58%) are covered by sales-oriented systems more frequently than others. This stands in contrast to MBO distribution.

Conclusions

The following conclusions can be drawn from the above analysis: the first thesis propounding the segmentation of banks in Poland according to the Management by Objectives system was confirmed by the conducted study. The observed differences varied in intensity. There were both major differences relating to the kind of bank (commercial vs. cooperative; majority domestic vs. majority foreign capital) and minor ones, such as the age of employees embraced by MBO. The second thesis concerned the job positions covered by MBO and assumed that the managerial staff are subject to MBO more frequently than the non-managerial employees. This thesis was proved to be correct. However, in this case the significance level exceeded 5%. The third thesis was relating to more

frequent MBO occurrence among employees with longer job seniority in the current workplace than among people at the beginning of their employment in a particular unit. The study results disproved this thesis statement. As it turned out, employees with shorter seniority are involved in the MBO system more frequently than others. The last two these have been proved true. A detailed analysis has confirmed that male employees in banks are covered by the Management by Objectives system more frequently than females. The last thesis postulating that bank staff with tertiary education are subject to the Management by Objectives more often than employees with secondary education has been proved true.

One could put forward a number of recommendations regarding the system of Management by Objectives. One issue which needs to be changed is the Human Resource management in cooperative banks and banks with majority domestic capital. They use outdated HR management techniques and, consequently, are not able to exploit fully the potential of their employees. In their case, MBO may turn out to be a useful tool. Another area which requires change is the approach to MBO. It so happens that Human Resource managers attempt to introduce other modified systems under the guise of MBO. These often have hardly anything in common with the general assumptions of the system as recommended by P.F. Drucker and as such do nothing to improve the system of management. Such practices lead to the negative reputation that the system of Management by Objectives has undeservedly acquired.

These considerations leave ample room for further analyses. An interesting area of detailed research could deal with the perception of the MBO system by the employees themselves. It could include the assessment of the system in relation to the kind of position held by the respondent. A comparison of an organization's financial results prior to and after the introduction of MBO would also make an interesting object of study.

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Jerzy KAŻMIERCZYK (PhD) is a Postdoc at Tyumen State University and Assistant Professor at Poznan University of Economics and Business, Member of the Research Council of Polish Economic Society, Member of the Presidium and Board of Polish Economic Society Zielona Góra and Member of the Regional Labour Market Board at Lubuskie Marshal's Office. He is currently editing an issue of *Studia Oeconomica Posnaniensia* and issue of *Scientific Journal of Polish Economic Society in Zielona Góra*. Research interests: labour market, HRM, banking, macroeconomics.

ORCHID ID: orcid.org/0000-0002-5976-0210

Mateusz APTACY is a graduate of Poznan University of Economics and Business and practitioner of HRM in banking. Research interests: Management by Objectives, Human Resources Management, labour market.



ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

CAMELS+T APPROACH FOR BANKS' SOUNDNESS ASSESSMENT: EVIDENCE FROM THE BALTICS

Daiva Jurevičienė¹, Viktorija Skvarciany²

^{1,2} Vilnius Gediminas Technical University, Saulėtekio ave. 11, LT-10223 Vilnius, Lithuania

E-mails: ¹daiva.jureviciene@vgtu.lt; ²viktorija.skvarciany@vgtu.lt

Received 20 June 2016; accepted 15 September 2016

Abstract. The findings of the research contribute towards commercial banks' soundness assessment. The current study focuses on the importance of customers' trust for banks' soundness and the expanded CAMELS+T model was suggested where "T" stands for customer trust. For testing CAMELS+T model expert evaluation method was used Pairwise comparison method was used for factors' ranking. The outcomes of the experts' pairwise comparison were generated using analytic hierarchy process (AHP) based on classical and balanced scales and fuzzy analytic hierarchy process (FAHP) technique. The model was tested in the Baltic countries. Three forms of banking were analysed: traditional banking, internet banking and mobile banking in the current research. The results of the study showed that customer trust is one of the vital factors positively influencing the soundness of commercial banks. Therefore, the results contribute to the studies relating bank performance, as it confirms that trust is a powerful tool in commercial banks' soundness building process. The results of the research are useful for commercial banks' soundness' assessment as soundness is considered the factor that is necessary not only for customer retention but also for customer acquisition. The findings have implications on the development of the strategy and the policy of commercial banks. Moreover, the results are valuable for investors as the soundness of commercial bank is the criterion investors should take into consideration while choosing a bank they are going to work with.

Keywords: trust, soundness, traditional, internet, mobile banking, CAMELS+T model, analytic hierarchy process (AHP), fuzzy analytic hierarchy process (FAHP)

Reference to this paper should be made as follows: Jurevičienė, D.; Skvarciany, V. 2016. Camels+t approach for banks' assessment: evidence from the Baltics, *Entrepreneurship and Sustainability Issues* 4(2): 159-173. DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(4\)](http://dx.doi.org/10.9770/jesi.2016.4.2(4))

JEL Classifications: G21, C51

1. Introduction

Scientists from various countries widely analyse the concept of financial sector soundness, as soundness is one of the most important factors, promoting sustainable development of banking sector itself and important factor of sustainable development of countries (Al-Khouri, Arouri, 2016; Motelle, Biekpe, 2014; Lui, 2013; Dubauskas,

2012; Kaźmierczyk, 2012; Milvydienė, 2012; Lankauskienė, Tvaronavičienė 2012; Stasytė 2015; Fuschi, Tvaronavičienė 2014; Kalyugina et al., 2015; Korauš et al., 2016).

Overall financial soundness depends on banks' soundness (Podvieszko, Ginevičius, 2010; Warjiyo, 2016, Tamulevičienė, 2016). Low level of banks' soundness weakens entire banking system and makes the country more exposed to financial crises (Park, 2012). The soundness of banking sector is the most important principle of global financial soundness (Dima et al., 2014) and it is very important to avoid such crises as the last one in 2008. Thus, the soundness of banking sector is the basis of overall financial system consistency as banks play the most important role in the money creation process, payment systems, investments financing and development of economy (Hussein, 2010). As it was already mentioned above, the soundness of banks is necessary condition for sustainable economic growth (Ginevičius, Podvieszko, 2013; Karanovic, Karanovic, 2015; Menicucci, Paolucci, 2016) and overall economic stability (Fernández et al., 2016; Dudzevičiūtė et al. 2014).

Many scientists use CAMELS model for evaluation of banks' soundness, which was proposed in 1996 (Sahajwala, Van den Bergh, 2000). For more than twenty years, economic and political situations in countries have been changing, information technologies have been evolving and electronic banking has gained popularity. Due to the above-mentioned changes, there is a necessity to modify the methodology in assessing commercial banks' soundness, to revise soundness determinants.

One such factor is the private consumer confidence in commercial banks that is being examined by a number of scientists. Furthermore, researchers exploring the confidence of commercial banks agree that this is one of the most important factors in determining the success of the banking activities.

Therefore, the goal of the current paper is to explore whether there is an interface between customers' trust and commercial banks' soundness. Based on the literature analysis of main factors of banks' soundness, the following hypothesis was stated:

H: *Trust is one of the vital factors influencing commercial banks' soundness.*

Three forms of banking were analysed: traditional banking, internet banking and mobile banking in the current research. Expert evaluation method was used for data collection. Results were analysed using analytical hierarchy process (AHP) using classical and balanced scales and AHP based on fuzzy logic. The current research contributes to scientific literature in the field of banks' soundness assessment methods. The results of the study showed that there is a need to modify CAMELS model to CAMELS+T model, where "T" stands for "trust".

2. Interface between trust and soundness in banking

Scientists dealing with commercial banking sector agree that trust is a determinant of successful banking operations. Trust promotes cooperation between the bank and the customer, it allows the bank to maintain / gain competitive advantage. Increasing diversity of services provided by commercial banking requires customer trust, which becomes a factor encouraging customer to make a decision regarding choosing the bank. Thus, trust is a crucial factor, ensuring not only the smooth functioning of the banking activities, but also the soundness and development of its activities. In addition, trust provides high-quality social relationships with the banking service users and partners. Hence, examination of consumer trust, as one of the factors of soundness, will help to understand the form and strength of the impact of trust on soundness as well as to strengthen these success factors ensuring the activities of banks.

In the post-crisis period, scientists began to emphasize the link between customer trust and soundness of commercial banks. For instance, according to Gao et al. (2016) the high level of investors' trust directly influences the soundness of the financial system. Actually, commercial banks are the major part of the financial system, hence it could be

concluded that there is a positive correlation between the customer trust and the soundness of commercial banks. Sokolova, Tishina (2015) say that there is a close relation between the banks' business soundness and trust in commercial banks. In fact, the greater the level of customer trust the higher the level of the soundness of commercial banks (Fungáčová, Hasan, 2016). Loss of trust is so important that there is a problem for the financial soundness as well (Nicolaci, 2014). Undermining trust impinges negatively upon the soundness of financial system (Minto, 2016), in particular upon the soundness of commercial banks. Carretta et al. (2015) highlight indirect correlation between trust and soundness. The authors emphasize collectivism to be positively linked to the soundness of commercial banks while one of the collectivism elements is trust (Carretta et al., 2015).

According to the interface between trust and soundness provided by scientists it is proposed to modify the existing soundness assessing CAMELS model – adding to it the trust factor. It is offered to name CAMELS+T the expanded model. Fig. 1 shows graphic representation of the model.

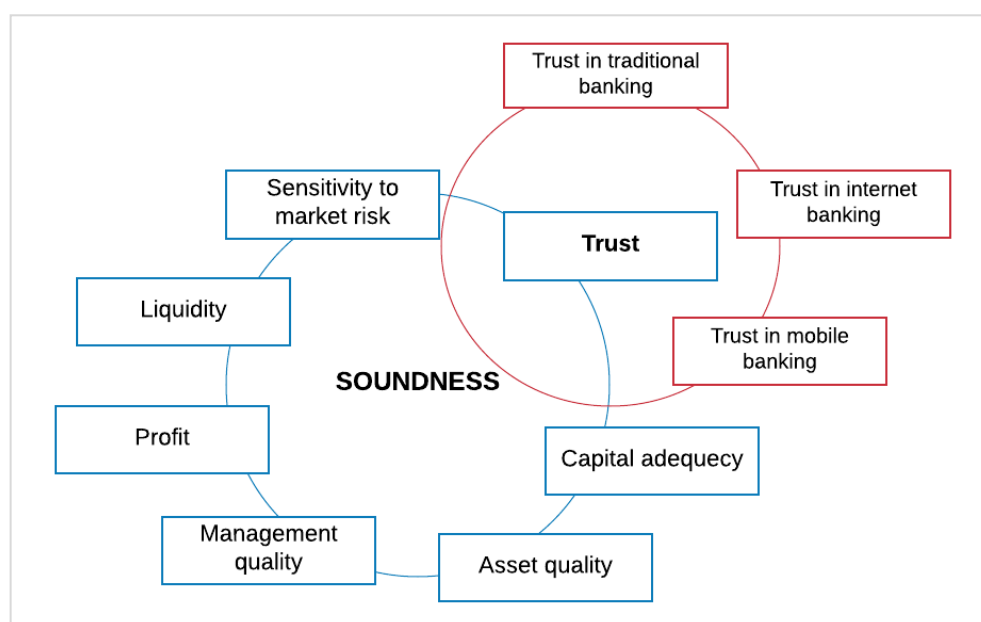


Fig.1. Graphic Representation of CAMELS+T Model

Source: designed by authors

It can be seen in Fig. 1, that the proposed CAMELS + T model is a seven-factor model including trust. Trust is depicted as union of trusts in three banking forms. In fact, many researches study the theoretical aspects of the relationship between trust and soundness of banks, but there is a lack of empirical studies analysing the influence of trust on the soundness of commercial banks. For this reason, this article investigates the impact of consumer trust on the soundness of commercial banks empirically and studies the generated results that can be adapted to the development of commercial banking business.

The World Economic Forum announces commercial banks activities soundness' data annually (Schwab, 2008-2016). Experts assess banks' soundness using seven-point Likert scale. The diagram of banks soundness values for Lithuania, Latvia and Estonia is presented in

Fig. 1 for the period 2008-2016.

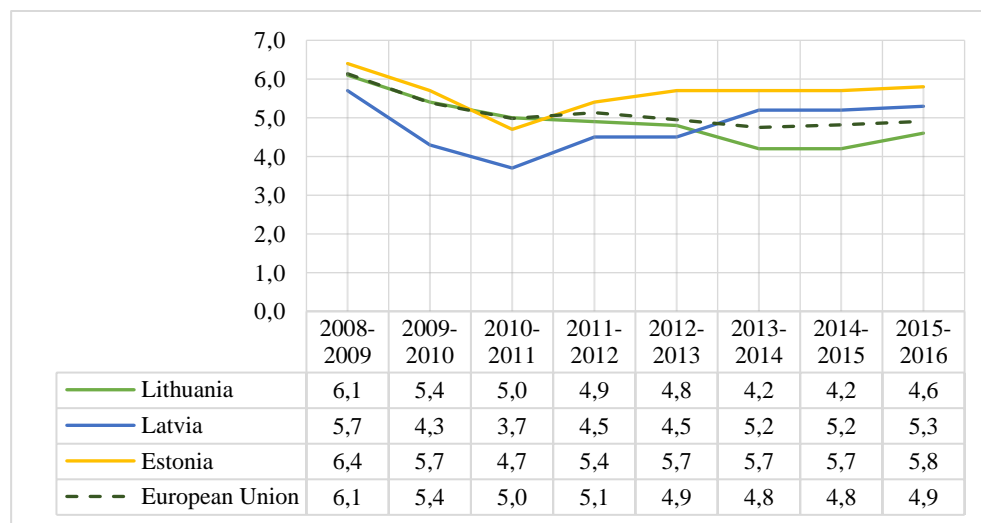


Fig. 1. Analysis of Commercial Banks' Soundness Situation in the Baltic Countries

Source: designed by authors based on Schwab (2008-2016)

According to Fig. 2, Latvia's and Estonia's banks' soundness assessment is higher than the European Union's average in recent years. However, assessment of soundness in Lithuania's banks is 0.3 points lower than the EU average in 2015-2016. What is more, neither the EU banks soundness' average assessment nor Baltic States' banks' soundness assessment has reached the level before the global financial crisis. One of the factors that could support the high level of bank soundness is trust. To understand the significance of trust level it is necessary to clarify the weight of trust factor in soundness building process.

3. Methodology

The expert evaluation method was chosen for data collecting. The number of respondents in expert evaluation was picked out according to Libby and Blashfield (1978) recommendations. According to Libby and Blashfield (1978) the reliability of the results obtained by the group of five experts exceeds 75 percent threshold. Pairwise comparison method used for ranking. According to this technique, each alternative matches one-on-one with each of the other alternatives what gives a more precise rating. The outcomes of the experts' pairwise comparison were generated

using analytic hierarchy process (AHP) based on classical and balanced scales and fuzzy analytic hierarchy process (FAHP).

3.1. Analytic hierarchy process

Analytic hierarchy process is multidimensional method that could be applied when it is necessary to take into account several criterion for decision making (Zolfani, Antucheviciene, 2012).

AHP method, using classical and balances scales, was selected to assess CAMELS+T model dimensions influence on banks' soundness. Analytic hierarchy process is a multicriterial model designed for decision-making. There are several assessment criterion that ought to be taken into account (Zolfani, Antucheviciene, 2012).

According to the method experts compare alternatives $\{\theta_1, \dots, \theta_n\}$ with each other by filling pairwise comparison matrices (see (1)).

$$A = (a_{ij})_{n \times n}, \quad (1)$$

where: $a_{ij} = \frac{\omega_i}{\omega_j}, \forall i, j = 1, 2, \dots, n,$

$\omega_n (n = 1, 2, \dots, n)$ – priority vector,

$$a_{ij} = \frac{1}{a_{ji}}, \forall i, j = 1, 2, \dots, n.$$

For completing individual comparison matrices experts were suggested to use nine-point scale introduced by Saaty (Saaty, 1980) (see Table 1). Every expert had to evaluate $(n(n - 1) / 2)$ pairs (n – number of alternatives).

• Table 1. Scales of Relative Importance

Estimation	Linguistic variables
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong or demonstrated importance
9	Extreme importance
2, 4, 6, 8	Intermediate values
Reciprocals to above	If factor i has one of the above numbers assigned to it when compared to factor j , then j has reciprocal value when compared with i

Source: Saaty (1988)

However, the scale presented in Table 1 is not the only used for pairwise comparison. For instance, Salo, Hamalainen (1997) proposed balanced assessment scale. Linear and balanced scales' characteristics are presented in Table 2.

Table 2. AHP Scales Used in the Survey

Type of scale	Mathematical expression	Parameters	Approximate scale values
Linear (Saaty, 1977)	$s = x$	$x = \{1, 2, \dots, 9\}$	1; 2; 3; 4; 5; 6; 7; 8; 9
Balances (Salo & Hamalainen, 1997)	$s = \frac{w}{1 - w}$	$w = \{0,5; 0,55; 0,6; \dots; 9\}$	1; 1,22; 1,5; 1,86; 2,33; 3; 4; 5,67; 9

Source: Ishizaka and Labib (2011)

As shown in Table 2, different scientists offer different numeric scales to the same linguistic scales given in Table 1. The choice of the best scale is still debatable. For example, Goepel (2013) offers to use balanced scale along with the classical (linear) scale as using balance scale reduces inconsistency in experts' evaluations.

Salo, Hämäläinen (1997) claim that their proposed balanced scale improves the sensitivity of relative scales of AHP. Scientists offer natural number scale (from 1 to 9) providing the weights of the factors that are not equally distributed, which leads to two factors, placed next to each other, reducing sensitivity of comparison (Franek, Kresta, 2014). In other words, local weights are evenly distributed through the global weight range using balanced scale. However, the scientists claim that classical scale should be used by default and balanced scale could be additional one if there is a necessity to reach higher level of consistency (Franek, Kresta, 2014).

After experts complete pairwise comparison of the factors, all the assessments have to be written in standardised matrix form and arithmetic mean of each line is calculated. In this way, the main factor is identified. However, if the level of inconsistency is higher than the set limit, the matrix had to be modified into consistent one as consistency of the matrices shows whether experts' factors evaluations were logical and reliable. Pairwise comparison matrix is considered as consistent if $a_{ik} = a_{ij}a_{jk}, \forall i, j, k$. In other words, there is such priority vector $w = (\omega_1, \dots, \omega_n)$ that $a_{ij} = \omega_i / \omega_j, \forall i, j$. Analytic hierarchy process is the method that evaluates the consistency of each individual expert assessment within Consistency Index (*CI*) (Saaty, 2012). To determine consistency index an eigenvalue of pairwise comparison matrix is calculated (see (2)).

$$\lambda_{max} = \sum_{j=1}^n \frac{(A \cdot v)_j}{n \cdot v_j}, \quad (2)$$

where: λ_{max} – the largest eigenvalue of matrix A,
 n – number of independent rows in the matrix,
 v_j – eigenvalue of the matrix.

If experts' pairwise comparison matrix A is consistent, $\lambda_{max} = n$. If there are minor a_{ij} changes and matrix A does not satisfy consistency condition, then the λ_{max} value is close to n . After the value of λ_{max} is computed, consistency index *CI* could be calculated (see (3)).

$$CI = \frac{\lambda_{max} - n}{n - 1}, \quad (2)$$

where: *CI* – consistency index,
 n – number of alternatives.

For the purpose of consistency index assessment it was compared to Random Index (*RI*) and Consistency Ration (*CR*) was computed (see (4)).

$$CR = \frac{CI}{RI}, \quad (3)$$

where: *CR* – consistency ratio,
 RI – random index.

The values of consistency ratio depend on matrix order m . They are presented in Table 1.

Table 1. Values of Random Index (*RI*)

n	1	2	3	4	5	6	7	8	9	10
<i>RI</i>	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Source: Van Laarhoven and Pedrycz (1983)

AHP method is considered as appropriate if $CR \in [0; 0,2)$ (Aksenov et al., 2014). If the matrix is inconsistent, it is modified by the method proposed by (Saaty, 2012). Obata et al. (1999) called the method Method-S. The steps of the method are as follows (Davoodi, 2009; Obata et al., 1999):

- i) determining the priority weight vector $\omega = (\omega_i)$ by the eigenvector method;
- ii) comparison of each value a_{ij} with the corresponding ratio of weights ω_i/ω_j ;
- iii) identification of the most different element as inconsistent, and a_{ij} replacement with ω_i/ω_j ;
- iv) estimation of the priority weights from the modified matrix.

For experts' pairwise comparison matrices that fulfil the consistency condition ($CR < 0,2$), the aggregated experts' assessment is calculated. Aggregated experts' assessment is calculated using geometric mean (see (5)) (Kostin, 2014).

$$a_{ij}^A = \sqrt[n]{a_{ij}^1 \times a_{ij}^2 \times \dots \times a_{ij}^n}, \quad (4)$$

where: a_{ij}^A – assessment of aggregated element that belongs to i row and j column.

n – number of pairwise comparison matrices composed by one expert.

Consistency ratio calculation procedure is repeated for the resulting matrix and if the aggregated matrix is consistent, priorities are computed using the normalized geometric mean method (see , (5)) (Franek, Kresta, 2014).

$$\omega_j = \frac{\sqrt[i]{\prod_{j=1}^i a_{ij}^A}}{\sum_{j=1}^i \sqrt[i]{\prod_{j=1}^i a_{ij}^A}}, \quad (5)$$

where: ω_j – weight of j alternative.

What is more, experts' consensus index, which was offered by Goepel (2013) is calculated. AHP consensus index compares experts' numerical estimations of criteria. The results vary from zero to 100 percent and show the level of agreement between the experts. Consensus index is calculated using the formula presented below (see (7)) (Goepel, 2013).

$$S^* = \frac{1/\exp(H_\beta) - \exp(H_{\alpha min})/\exp(H_{\gamma max})}{1 - \exp(H_{\alpha min})/\exp(H_{\gamma max})}, \quad (6)$$

where: S^* – consensus index,

H_α – Shannon alpha diversity,

H_β – Shannon beta diversity,

H_γ – Shannon gamma diversity.

3.2. Fuzzy analytic hierarchy process

Many scientist analyse Saaty's proposed pairwise comparison AHP method. Along with the AHP method, scientists analyse nine-point scale that is used for carrying out the comparison procedure. As a result, there are scientists who started claiming that nine-point scale does not fit expert evaluation procedure. Therefore, scale based on fuzzy logic was proposed (van Laarhoven, Pedrycz, 1983). Scientists suggested using triangle fuzzy numbers (van Laarhoven, Pedrycz, 1983).

AHP method based on fuzzy numbers (*Fuzzy AHP*, FAHP) was created to reduce uncertainty while calculating factors' weights (Ishizaka, Nguyen, 2013). In fact, respondents' linguistic assessments of the same factor could

differ due to human nature and character, hence, it is necessary to take uncertainty into consideration to make a less risky decision (Sehra et al., 2012). In other words, using fuzzy AHP increases calculations' accuracy (Vinogradova, 2012).

In the present research, triangle fuzzy numbers were based on numerical assessment provided for experts' evaluations. Actually, triangular fuzzy numbers are commonly used to find an appropriate solution to practical problems. Triangle fuzzy number \tilde{A} is represented by (l, m, u) , and the membership function is defined by equation (8) (Beşikçi et al., 2016).

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-l}{m-l}, & x \in [l; m]; \\ \frac{u-x}{u-m}, & x \in [m; u]; \\ 0, & x \notin [l; u], \end{cases} \quad (7)$$

with $-\infty < l \leq m \leq u < +\infty$;

where: $\mu_{\tilde{A}}(x)$ – triangle-shaped membership function,
 m – the best estimate (the most probable value),
 l – the lowest estimate,
 u – the highest estimate.

The essence of FAHP method is that experts compare all the factors to each other. The assessment of experts' opinion is carried out using triangular fuzzy-number scale, which is designed according to triangle-shaped membership function (see Table 3).

• **Table 3.** Fuzzy Pairwise Comparison Scale

Intensity of Importance of one criteria over another	Fuzzy number, \tilde{a}_{ij}	Triangular fuzzy numbers
Equal alternatives	$\tilde{1}$	(1, 1, 1)
Equal importance		(1, 1, 2)
Moderate importance	$\tilde{3}$	(2, 3, 4)
Strong importance	$\tilde{5}$	(4, 5, 6)
Very strong or demonstrated importance	$\tilde{7}$	(6, 7, 8)
Extreme importance	$\tilde{9}$	(8, 9, 9)
Intermediate values	$\tilde{2}, \tilde{4}, \tilde{6}, \tilde{8}$	(1, 2, 3), (3, 4, 5), (5, 6, 7), (7, 8, 9)

Source: Cobo et al. (2014)

Every expert has to make $n(n-1)/2$ comparisons in order to design pairwise comparison matrix that is defined by the equation (9) (Cobo et al., 2014).

$$\tilde{A} = \tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}), \quad (8)$$

where: $m_{ij} = \frac{\sum_{t=1}^T a_{ij}^t}{T}$,

$l_{ij} = \min_t a_{ij}^t$,

$u_{ij} = \max_t a_{ij}^t$,

T – number of experts,

$t = 1, 2, \dots, T$,

$\tilde{a}_{ji} = \frac{1}{\tilde{a}_{ij}}, \forall i, j = 1, 2, \dots, n$.

For experts' pairwise comparison matrices that satisfy the consistency condition ($CR < 0,2$), the aggregated experts' assessment is calculated using a formula that is based on geometric mean (see (10)) (Lju, 2014).

$$\tilde{a}_{ij}^A = (\tilde{a}_{i1} \otimes \tilde{a}_{i2} \otimes \dots \otimes \tilde{a}_{in})^{1/n}, \quad (10)$$

where: \tilde{a}_{ij}^A – assessment of aggregated element that belongs to i row and j column.
 n – number of pairwise comparison matrices composed by one expert.

After aggregated experts' assessments are calculated the fuzzy weights of the criteria are computed (see (11)) (Lju, 2014).

$$\tilde{w}_i = \tilde{a}_{ij}^A \otimes (\tilde{a}_{i1}^A \oplus \tilde{a}_{i2}^A \oplus \dots \oplus \tilde{a}_{in}^A)^{-1}, \quad (11)$$

where: $\tilde{w}_i = (Lw_i, Mw_i, Uw_i)$ – fuzzy weight of i alternative,
 Mw_i – the best fuzzy estimate (the most probable value),
 Lw_i – the lowest fuzzy estimate,
 Uw_i – the highest fuzzy estimate.

After fuzzy weights of each criterion is calculated, the most important factor is identified.

4. Empirical Findings

In order to get reliable research results the following requirements were set for the experts: 1) to have work or research experience in the banking sector; 2) to have at least a Master's degree in one of the following study areas: finance, economics, econometrics, management or business administration. In order to conduct the survey, three groups of experts (i.e. a group from each Baltic country) were selected based on non-probability sample. There were five experts in each group. Three forms of banking were analysed: traditional banking, internet banking and mobile banking in the current research. Experts had to rate the factors of CAMELS+T model to determine the level of the importance of each factor of the offered model in order to examine their influence on soundness of banks. The following results were obtained with 75 percent reliability.

Analysing experts' individual comparison matrices in the context of traditional banking, it was found that the use of classical AHP scale matrices, constructed by experts, coded EC+T_{LT3}, EC+T_{LV2}, EC+T_{EE1,2,5}, appeared to be inconsistent, while using AHP balanced scale only two matrices, created by experts, coded EC+T_{LT3}, EC+T_{LV2}, needed to be modified. Hence, before continuing computations, matrices were modified into consistent ones. Additionally, fuzzy numbers were used for the purpose of CAMELS+T model testing. The results of the CAMELS+T factors where "T" stands for "trust in traditional banking" assessments are given below (see Table 4). Consistency ratio and lambda (λ) meet the given conditions (see Table 4); consequently, experts' aggregated assessments could be used for obtaining general results.

• **Table 4.** Weights of the CAMELS+T model's factors in the context of traditional banking

Normalized eigenvector									
Country	LT			LV			EE		
Method	AHP		FAHP	AHP		FAHP	AHP		FAHP
Scale	Class.	Balan.		Class.	Balan.		Class.	Balan.	
C	0,071	0,079	0,000	0,104	0,108	0,059	0,081	0,106	0,017
A	0,136	0,138	0,120	0,088	0,110	0,043	0,121	0,142	0,123
M	0,154	0,163	0,194	0,151	0,145	0,200	0,200	0,181	0,255
E	0,063	0,085	0,000	0,126	0,118	0,077	0,128	0,141	0,100
L	0,173	0,160	0,241	0,187	0,181	0,261	0,239	0,196	0,285
S	0,123	0,132	0,028	0,114	0,132	0,098	0,046	0,075	0,000

T	0,280	0,243	0,417	0,229	0,206	0,262	0,184	0,159	0,220
Parameters									
λ	7,171	7,109	7,171	7,178	7,086	7,178	7,133	7,137	7,133
CR	0,021	0,014	0,021	0,022	0,011	0,022	0,016	0,017	0,016
Cons., %	59,6	79,7	59,6	42,6	66,1	42,6	63,4	86,1	63,4

Source: authors' calculations

As shown in Table 4, Latvian and Lithuanian experts ranked trust in the highest position in bank's soundness building process. In fact, clients' trust in traditional banking is more significant than the other criterion's weights and exceeds 20 percent limit. Thus, it can be concluded that trust in traditional banking system is necessary to ensure soundness of commercial banks. Lithuanian experts assessed capital adequacy and bank's earnings as factors that overall have no impact on banks' soundness. These results can be explained by the fact that every bank has a license, ensuring a minimum level of capital adequacy. That is to say, if the level is higher than the mandatory minimum, it does not affect banks' soundness. Estonian experts have marked liquidity as a key factor having impact on banks' soundness and trust was ranked at third position. Analysing Estonian experts' assigned weights for examined factors, it can be seen, that there are no outliers which means that differences between the weights of the factors are not so essential, compared to Lithuanian and Latvian experts. Actually, the only factor that stands out in the case of Estonia is the sensitivity to market risk that was evaluated as having the lowest weight in banks' soundness building process. Moreover, according to Estonian experts, sensitivity to market risk is equal to zero, if assessed with FAHP method. This is to say, there is no relationship between sensitivity to market risk and commercial banks' soundness.

In online banking, the effects of trust on soundness have also been examined, using the expert evaluation method. Investigating the pairwise comparison of CAMELS+T criteria by experts in Baltic countries matrices showed that EC+T_{LT3}, EC+T_{LV3}, EC+T_{EE2,5} matrices in classical scaling and EC+T_{LT3}, EC+T_{LV3} matrices in balanced scaling were inconsistent. Therefore, before aggregating global results, mentioned matrices were modified, according to method-S, presented in the methodology part. Triangles, fuzzy numbers were also used for results generation as experts' evaluations are often uncertain. The weights of CAMELS+T model factors throughout investigation process of trust in internet banking are presented in Table 5. Consistency ratio and lambda (λ) meet the given conditions (see Table 5) and indicate that the aggregated experts' evaluations may be used for obtaining general results. The weights of CAMELS+T model factors throughout investigation process of trust in internet banking are presented in Table 5.

• Table 5. Weights of the CAMELS+T Model's Factors in the Context of Internet Banking •

Normalized eigenvector									
Country	LT			LV			EE		
Method	AHP		FAHP	AHP		FAHP	AHP		FAHP
Scale	Class.	Balan.		Class.	Balan.		Class.	Balan.	
C	0,071	0,079	0,022	0,065	0,082	0,017	0,080	0,108	0,055
A	0,100	0,121	0,021	0,083	0,092	0,000	0,101	0,128	0,099
M	0,131	0,135	0,112	0,143	0,154	0,248	0,179	0,171	0,203
E	0,076	0,091	0,000	0,116	0,116	0,080	0,215	0,182	0,215
L	0,198	0,191	0,285	0,105	0,121	0,253	0,169	0,169	0,202
S	0,128	0,150	0,094	0,096	0,124	0,079	0,041	0,074	0,000
T	0,196	0,234	0,466	0,392	0,312	0,324	0,214	0,168	0,225
Parameters									
λ	7,124	7,090	7,124	7,121	7,122	7,121	7,252	7,130	7,252
CR	0,015	0,011	0,015	0,015	0,015	0,015	0,031	0,016	0,031
Cons., %	61,6	77,4	61,6	58,1	74,7	58,1	64,3	86,5	64,3

Source: authors' calculations

The examination of the weights of CAMELS+T factors, illustrated in Table 5, shows that Latvian and Lithuanian experts ranked trust to be in the first position in the context of internet banking. Moreover, the share of trust in internet banking reaches almost 20 percent, according to Lithuanian and Latvian experts. In fact, it shows that users' tendency to rely on online services provided by commercial banks, i.e. trust in internet banking, is the fundamental factor in building soundness of commercial banks' and supporting process. In fact, if people did not trust online banking, the usage of the service would decrease, which in turn would weaken banks' soundness.

Meanwhile, analysis of Estonian experts' answers demonstrate that trust assessment depends on the scale, used in the survey. Using classical scale experts set trust in the second position; using balanced scale – the fourth position; using fuzzy logic scale – the first position. In fact, investigation of other factors' weights illustrate that there is no significant difference between liquidity, earnings, management quality and trust weights, therefore, Estonian experts assess trust as the key factor in commercial banks soundness' development along with other factors.

Analysing the pairwise comparison matrices by experts in the Baltic States, assessing factors of CAMELS+T model, when "T" stands for trust in mobile banking, inconsistent matrices were identified. They are coded as follows: EC+T_{LT3}, EC+T_{LV3}, EC+T_{EE2,5} using classical scale and EC+T_{LT3}, EC+T_{LV3} using balanced scale. After modification of matrices, CAMELS+T model was tested not only using AHP classical and balanced scales, but also triangles, fuzzy numbers. The weights of the examined factors are shown in Table 6.

Consistency ratio and lambda (λ) meet the given conditions and indicate that the aggregated experts' evaluations may be used for obtaining general results.

Table 6. Weights of the CAMELS+T Model Factors in the Context of Mobile Banking

Normalized eigenvector									
Country	LT			LV			EE		
Method	AHP		FAHP	AHP		FAHP	AHP		FAHP
Scale	Class.	Bal.		Class.	Bal.		Class.	Bal.	
C	0,082	0,089	0,000	0,064	0,082	0,009	0,079	0,107	0,067
A	0,070	0,087	0,000	0,077	0,092	0,000	0,092	0,126	0,072
M	0,114	0,110	0,000	0,133	0,145	0,259	0,192	0,184	0,222
E	0,09311	0,111	0,000	0,118	0,115	0,071	0,214	0,178	0,226
L	0,181	0,169	0,279	0,116	0,125	0,282	0,167	0,167	0,193
S	0,09313	0,117	0,000	0,094	0,122	0,040	0,042	0,073	0,000
T	0,367	0,317	0,721	0,397	0,320	0,340	0,213	0,165	0,220
Parameters									
λ	7,165	7,086	7,165	7,125	7,103	7,125	7,243	7,121	7,243
CR	0,020	0,011	0,020	0,016	0,013	0,016	0,030	0,015	0,030
Cons., %	60,2	68,9	60,2	59,4	75,9	59,4	73,2	88,7	73,2

Source: authors' compilations

The results, presented in Table 6, are similar to the results, generated while testing CAMELS+T model in traditional banking and trust in internet banking. An obvious example is Lithuanian and Latvian experts' opinions showing that consumer trust in mobile banking is the vital factor, ensuring soundness of commercial banks. This could be explained by the fact that mobile banking is a relatively new service, and people tend not to rely on new services, due to the lack of experience using it. Thus, it is necessary to build clients' trust in mobile banking as it might ensure

common usage and further development of mobile banking service. Meanwhile, Estonian experts ranked trust in mobile banking to be in the second and the fourth positions, assessing by classic and balanced scales respectively. Obviously, according to Estonian experts trust in mobile banking is not the most important factor to ensure commercial banks' soundness. Nevertheless, the weight of trust should not be underestimated, according to the survey, conducted in Estonia; in this case, the weights of all the factors are distributed evenly which means there are no extreme outliers. In other words, Estonian experts claimed that a high level of commercial banks' soundness could be reached if all the factors of CAMELS+T models work together. It could be explained by the fact, that Estonian residents' level of trust in mobile banking is higher than in the neighbouring Baltic countries, therefore, Estonians pay attention not only to trust in mobile banking, but also to other factors of banks' soundness. Regarding the weights of factors, calculated based on fuzzy logic method, it could be seen that there are factors that do not have impact on banks' soundness. In Lithuania, these factors include capital adequacy, asset quality, management quality, profit, and sensitivity to the market risk, in Latvia – asset quality, in Estonia – sensitivity to market risk. Such results could be explained by the fact that users of mobile banking equate the service not only with the bank whose services they use, but also with the mobile operator, they use.

Conclusions

The study analyses the importance of customer trust for development of banks' soundness. In consistency with the main objective of the article, banks' soundness assessment model CAMELS was modified into CAMELS+T, adding the „T“ which stands for *customer trust* in commercial banks. In turn, trust was investigated in three forms as follows: trust in traditional banking, trust in internet banking, and trust in mobile banking. The proposed theoretical CAMELS+T model was tested empirically, using expert evaluation method as expertise was needed to understand questions properly. The research was conducted in Latvia, Lithuania and Estonia. Five experts from each country participated in the research. Experts had to rate the factors to determine the level of the importance of each factor of the offered model. Pairwise comparison method was used for ranking. The outcomes of the experts' pairwise comparison were generated using analytic hierarchy process based on classical and balanced scales and fuzzy analytic hierarchy process technique.

The results show that it is necessary to increase the level of customer trust in commercial banks, as it is one of the vital elements of soundness of banks. The research results show that the evidence supported the hypothesis and the theoretical CAMELS+T model could be used practically. The level of reliability of the results exceeds 75 percent threshold. According to the research results, trust in traditional banking is considered the most important factor in CAMELS+T soundness building model in Lithuania and Latvia. Estonian experts gave the third position for trust in traditional banking. Investigating weights of CAMELS+T factors in banks' soundness improvement in internet banking, Lithuanian and Latvian experts identified trust as the most important factor in banks' soundness, whereas, Estonian experts ranked trust in the second, the fourth and the first positions in internet banking, using AHP classical and balanced scales and FAHP techniques respectively. However, there is a slight difference in weights between trust in internet banking and other CAMELS+T factors. This is to say, trust in internet banking is almost as essential as other factors of models in banks' soundness building process. Lithuanian and Latvian experts set trust in the first position while examining the impact of trust in mobile banking on banks' soundness level. Estonian experts considered trust in mobile banking as one of the vital factors influencing high banks' soundness level, but they do not diminish the significance of other factors. In fact, trust in mobile banking was set in the second, fourth and third position, using AHP classical and balanced scales and FAHP techniques, respectively. Actually, the difference between the most and the least essential weights of factors is quite insignificant, hence, it could be said that all factors of CAMELS+T model are almost equal in building banks' soundness. According to the research findings, the high level of banks' soundness could be reached through raise of the level of customer trust in traditional, internet and mobile banking which means that the theoretical CAMELS+T model was confirmed to be suitable for building the soundness of commercial banks. The overall conclusion seems to be that, customer trust is a crucial

factor since customer trust strongly influences their choice of a commercial bank. In other words, the findings suggest modifying the CAMELS soundness model to CAMELS+T, where “T” stands for customer trust. Actually, the research results contribute to the science in the field of commercial banks’ soundness assessment by suggesting theoretical CAMELS+T model which is prepared to be tested in practice in different countries’ banking markets.

In order to understand fully customer trust's role in increasing banks’ soundness level further researches need to be conducted. A similar one is advisable in Nordic countries, as quite large section of banks, operating in the Baltics, are of Nordic origin. The results of such analysis would permit to use CAMELS+T model, instead of using CAMELS, assessing commercial banks’ soundness not only in Nordic and Baltic countries, but in other markets as well.

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Daiva JUREVIČIENĖ – Doctor of Social Sciences, professor; Department of Financial Engineering, Faculty of Business Management, Vilnius Gediminas Technical University. Research interests: banking, risk management, investments, personal finances, individual financial behaviour.

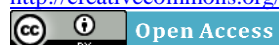
ORCID ID: orcid.org/0000-0002-0039-6290

Viktorija SKVARCIANY

ORCID ID: orcid.org/0000-0001-8022-4124; **RESEARCHER ID:** P-7584-2016



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ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

PRECONDITIONS OF SUSTAINABLE ECOSYSTEM: CYBER SECURITY POLICY AND STRATEGIES*

Darius Šttilis¹, Paulis Pakutinskas², Inga Malinauskaitė³

^{1,2,3} *Mykolas Romeris University, Ateities str.20, Vilnius, Lithuania*

E-mails: ¹ sttilis@mruni.eu; ² paulius.pakutinskas@mruni.eu; ³ inga.malinauskaite@mruni.eu

Received 17 May 2016; accepted 25 August 2016

Abstract. Ten years have already passed since the first cyber security strategies were drawn up in different countries reflecting global cyber security policy. The aim of this scientific article is to analyze the historical development of cyber security strategies of selected EU and NATO countries and to reveal future trends of cyber security policy. The article examines key elements of the selected strategies in the initial cyber security strategies and the description thereof in the already improved cyber security strategies. We selected countries with different allegiances. First, we chose two countries that are members of both the EU and NATO (the Netherlands and Estonia), then a country, which is only a member of NATO, namely, the United States of America, thirdly, an EU state, which is not a member of NATO, namely, Finland. We believe the research results may be used for both the development of current cyber security strategies, as well as for drafting a cyber security policy.

Keywords: cyber security strategy, historical development, entrepreneurship, policy

** This article is part of the research 'Analysis and adaptation of EU and NATO cyber security strategies: Lithuanian cyber security model', funded by the Research Council of Lithuania (Grant No. MIP-099/2015/PRC-36).*

Reference to this paper should be made as follows: Štitalis, D.; Pakutinskas, P.; Malinauskaitė, I. 2016. Preconditions of sustainable ecosystem: cyber security policy and strategies, *Entrepreneurship and Sustainability Issues* 4(2): 174-182.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(5\)](http://dx.doi.org/10.9770/jesi.2016.4.2(5))

JEL Classifications: O33; D80

1. Introduction

More and more countries have become some kind of victims of cyber-attacks on the one hand, and have realized the seriousness of cyber-attacks and the importance of cybersecurity on the other hand (Ventre D., 2015; Allabouche, et al. 2016; Samašonok, et al. 2016; Belás, et al. 2016). The concept ‘cyber security’ emerged in the 1990s, when the increasing dependence of the public on the development of information technologies was observed. Cyber security is associated with the creation and maintenance of processes related to the identification of emerging cyber threats and costs for the application of reasonable countermeasures (Shoemaker and Conklin, 2012). Cybersecurity is not an isolated objective, but rather a system of safeguards and responsibilities to ensure the functioning of open and modern societies (Klimburg A., 2012), also it's a precondition of sustainable ecosystem. The United States Computer Science and Telecommunications Board, which conducts scientific research in the field of cyber security each year, noted that cyber security is the main challenge of public policy (2015). Key components of cyber security are laid down in the main strategic documents, namely, cyber security strategies. In other words, cyber security strategies define and institutionalize the national cyber security system (Cezar, 2013).

The aim of this article is to reveal future insights into and tendencies of cyber security strategies. Origins of the cyber security regulatory initiatives may be associated with fragmented legal provisions in certain sectors. However, with the increase in cybercrime, the need to have new regulatory initiatives creating presumptions for a unified cyber security regulation has been growing. Documents in the cyber security area first appeared in the early 2000s. Russia adopted the National Security Concept of the Russian Federation in 2000; in 2003, the US passed the National Strategy to Secure Cyberspace; in 2005, Germany adopted a National plan for Information Infrastructure protection. It should be noted that for the most part these first documents were not yet referred to as cyber security strategies; they were more like plans, security strategies, information security strategies or strategies on critical infrastructures on the basis whereof countries later adopted cyber security strategies.

There has been a remarkable increase in the adoption of cyber security strategies since 2011. This was when most EU member states and other countries adopted cyber security strategies. For example, Luxembourg adopted its cyber security strategy in 2011, Georgia – in 2012, Italy – in 2013, and Denmark and Iceland – in 2014. Regional Cyber Security Strategy of the European Union approved in 2013 and Directive of the European Parliament and of the Council concerning measures for a high common level of security of network and information systems across the Union adopted in 2016. The objective of this Directive is to achieve a high common level of security of network and information systems in the Union while adopting minimum harmonisation requirements. It is noteworthy, that several countries have already adopted second versions of their cyber security strategies. The goal of this article is to research the historical development of the cyber security strategies of the selected European Union and NATO countries.

2. Methodology

Countries, whose cyber security strategies have demonstrated a significant change have been selected for the research. The research has been carried out by analyzing the content of the initial and second cyber security strategies of the selected countries. In particular we assessed constituent elements of cyber security strategies, such as threats and challenges, principles, methods, key goals and implementation. These particular elements were

chosen because it was noted they were key composite elements of both initial and second strategies, and comprehensively disclose the content of cyber security strategies. The course of the research evaluates the change of constituent elements of strategies throughout their history, examines how the content of the selected cyber security strategies has changed over time, solves issues and proposes methods to address various questions.

Countries that are members of the European Union and NATO, as well as those that are members of NATO or the European Union alone, were chosen for the research analysis. First, countries belonging to both the European Union and NATO, namely, the Netherlands and Estonia were chosen. Then, for further comparison of the historical development of cyber security strategies, a country which is a member of NATO alone, namely, the USA, was selected. And finally an EU member state which is not a member of NATO, namely, Finland. These four countries have already adopted second cyber security strategies. This different level of participation by countries in international organizations is believed to be able to reveal trends of cyber security strategies, and also to reveal regional cyber security perspectives.

3. National Cyber Security Strategies of the Netherlands of 2011 and 2013

The Netherlands adopted its first cyber security strategy in 2011. The first part of the strategy contained the presentation of the issue, principles and goals of the cyber security policy. The second part of the strategy established specific actions, which the Government had to implement together with other cooperating authorities. The first strategy of the Netherlands formulated fundamental cyber security principles, such as promotion of public and private partnership, active international cooperation, allocation of responsibilities between ministries, etc. The aim of the strategy was security and confidence in an open and free digital society. The second part of the strategy enshrined a specific action plan, including but not limited to the establishment of a cyber security council and the national cyber security centre, assessment of threats and risks, enhancement of the protection of critical infrastructures, development of possibilities to repel potential attacks, investigation of cybercrime and promotion of research and education.

The second cyber security strategy of the Netherlands was adopted in 2013. It emphasized the correlation between security, freedom and socioeconomic benefits. One of the fundamental principles enshrined therein is that responsibilities applicable in physical space should also apply in cyber space. Thus, in order for a dialogue on cyber security between various stakeholder groups to reach a new level of maturity, three key elements should be considered: the development of self-regulation, transparency and awareness. The second strategy clearly allocates the responsibilities of different authorities, namely, it identifies areas of responsibility of the government, the business sector and individuals.

The historical development of the cyber security strategies of the Netherlands can obviously be characterized by a significant change in its constituent elements. This valuable change of elements is reflected in a comparative table of key constituent elements of the cyber security strategies:

Table 1. Comparison of strategies

National Cyber Security Strategy of the Netherlands of 2011	National Cyber Security Strategy of the Netherlands of 2013
Partnership between public and private sectors	Participation of private and public sectors
Focus on structures	Focus on networks/strategic coalitions
Formation of a model of various related authorities	Refinement of responsibilities of related authorities

Capacity-building in the Netherlands	Capacity-building both in the Netherlands and other countries
General approach: distribution of capacities for enhanced protection measures	Risk-based approach: balance between protection of interests, threats and acceptable risks in society
Formation of fundamental principles	Presentation of policy (vision)
From ignorance to awareness	From awareness to capability

Table 1 specifically illustrates the changing approach to specific cyber security strategy elements. A change from the formation of initial elements to the refinement of specifics is seen. For example, where the first strategy formulated fundamental principles of cyber security, the second strategy establishes the presentation of policy (vision). Where the initial strategy formulated the model of related authorities, the second ones focuses on more specific responsibilities. The internationalization method of the cybersecurity phenomena should be noted. The second strategy of 2013 emphasizes capacity building both in the Netherlands and abroad and focuses more on the capabilities with the overall assumption that awareness has already been reached. The second strategy of the Netherlands also highlights a specific action plan laid out in the Annex to the strategy according to each goal.

4. National Cyber Security Strategies of Estonia of 2008 and 2014

The achievements which Estonia made in the area of cyber security came to light in 2007 when Estonia was the first country in the world to be the target of cyber-attacks. Shortly afterwards, in 2008, Estonia adopted its first cyber security strategy. The strategy has a very clear structure – an introduction, cyberspace threats, actions in the cyber security area, enhancement of cyber security in Estonia and implementation of cyber security. According to the Estonian Cyber Security Strategy of 2008, national implementation of cyber security should be based on such principles as cooperation between public and private sectors, protection of critical infrastructure, awareness raising etc. Cyber security threats are defined in the Estonian Cyber Security Strategy of 2008 as potential attacks, which are carried out remotely, using minimal resources and resulting in severe consequences. The action plan emphasizes the protection of Estonian information society and information infrastructure, security of information systems, practical trainings in the area of information security as well as the importance of legal cyber security regulation and international cooperation. To describe legal regulation in the Estonian strategy, a comprehensive review of key documents of international, regional and national legislation as well as of aspects of cooperation of international organizations was conducted.

In 2014, Estonia adopted a new cyber security strategy. It should be mentioned that the Estonian Cyber Security Strategy of 2008 was also considered to be one of the most advanced strategies in Europe (Laasme, 2012). Thus, the new strategy has consistently continued the implementation of most of the goals set in the strategy of 2008. Moreover, the new strategy incorporates new threats and needs, which were not provided for in the previous strategy. It should also be noted that when it comes to content, the new Estonian strategy is more concise. The strategy of 2014 analyses the current situation (the progress achieved in separate sectors, cyber security trends and other challenges). The increasing dependence of Estonia as a country, as well as of its economy and residents on information technology and electronic services is identified as the main challenge. The need for modern legal regulation has been highlighted as additional activity to repel threats listed in the new strategy. When comparing the principles laid down in the Estonian strategy of 2008 and the strategy of 2014, most of the principles identified in the strategy of 2008 can be seen to have prevailed in the strategy of 2014, with the only difference being in the formulation thereof. The main goal provided for in the Estonian Cyber Security Strategy of 2014 for the next four years (2014–2017) is to increase cyber security capabilities and raise the population’s awareness of cyber threats, while at the same time ensuring continued confidence in cyber space. The last part of the Estonian strategy of 2014 describes the related authorities responsible for strategic actions and lays down specific deadlines for the implementation of the actions.

In summarising the comparison of both strategies we notice some profound insights. First, a very important aspect of cyber security phenomena – continuity. The new strategy has consistently continued the implementation of most of the goals set in the strategy of 2008. Second, one outcome of this continuity is that many aspects in the second strategy remain the same, only the formulation differs slightly. The second strategy is found to be more concise, itemizing principles of cyber security, the overall objective of the strategy and additional goals.

5. National Strategy to Secure Cyber Space of the United States of 2003 and US International Strategy for Cyber Space of 2011

The first cyber security strategy document of the United States appeared in 2003 when the National Strategy to Secure Cyberspace was adopted. Compared to the strategies of the Netherlands and Estonia examined above, this strategy can be distinguished for its comprehensiveness and scope. In terms of content, the strategy consists of an introduction, threats and vulnerabilities of the cyber space, the national policy and tendentious principles as well as five priorities of the national cyber security.

The National Strategy to Secure Cyberspace of the US of 2003 emphasizes the efforts and priorities of the organization. It also establishes the direction for the actions of government and other organizations. Moreover, this document identifies specific actions to be undertaken by state and local governments, private companies and organizations as well as individuals in order to achieve a higher level of cyber security. Unlike the European cyber security strategies (the Netherlands and Estonia), the US has included each US citizen since 2003, emphasizing that everyone can contribute to the creation and development of cyber security. It is notable, that even if the strategy of 2003 is comprehensive, it distinguishes only three strategic goals. The 2003 National Strategy to Secure Cyberspace presents a vision stating that the protection of cyber security is a complex and constantly evolving challenge. The strategy mentions that this document is the first step to protecting information infrastructures in the long-term. The strategy mentions and distinguishes functions and responsibilities of federal and local governments.

The US International Strategy for Cyberspace was adopted in 2011. Its content consists of four parts: 1. Building cyberspace policy. 2. Cyberspace's future. 3. Policy priorities. 4. Moving forward. Cyber security regulation requires a coherent policy and media attention; it is a complex regulation of state and federal government, including various regulatory methods and areas of application (Thaw, 2014). Thus, the US strategy of 2011 emphasizes a strategic method based on success building, principles and recognizing challenges. This strategy is based on fundamental principles, such as respect for fundamental freedoms, recognition of privacy and free movement of information. The goal of the US International Cyberspace Strategy of 2011 is to work at the international level in order to promote open, interconnected, secure and reliable information and communication infrastructure, which supports international trade and commerce, strengthens international security and fosters free expression and innovation. The appropriate response to cybercrime can be achieved solely through international cooperation (Rosenzweig, 2012). In order to achieve this goal, the USA has been constantly building an environment with existing norms of responsible actions, reliable partnership and the support of the country's cyberspace under the rule of law. It should be noted that the development of such cyberspace norms in the country means that the country's actions have become predictable, and misunderstandings leading to conflict situations can be avoided. The idea behind the development of cyberspace norms emphasized in the strategy can also be found in scientific doctrine examining the occurrence of potential proactive cyber security norms in international law (Craig, Shackelford, Hiller, 2015).

Unlike other cyber security strategies, the US strategy of 2011 emphasizes the contribution of the United States themselves into the future of the strategy. The diplomatic goal of the United States is to develop initiatives and a common understanding of the international environment, where the states would work together as related

responsible authorities. Moreover, the strategy mentions that the states should strengthen partnership, protection, security of information networks and deterrence against hostile acts.

Summing up it might be concluded that compared to the European strategies, both US strategies emphasize the involvement and contribution of each individual to the cyber security improvement process. Another difference of the US strategies might be noticed in the description of the aims of the strategies. While both strategies are very comprehensive, both establish three (2003 strategy) and only one (2011 strategy) goal. In addition, the aspect of cyber security as a global matter is stressed in both of the US strategies.

6. National Information Security Strategy of Finland of 2008 and Cyber Security Strategy of Finland of 2013

The National Information Security Strategy adopted in Finland in 2008 is aimed at making each day in the information society secure and reliable for everyone. The vision of the strategy is the confidence of these bodies in the fact that information is secure when using various communication technologies and related services. The priorities of the National Information Security Strategy of Finland of 2008 establish the principles for the protection of a critical information society and international network cooperation. Finland is an integral part of the global information economy, and many threats are of international nature. Therefore, resistance to such threats is based on good preparation and efficient expansion of the international cooperation network and a clear vision of the future in the identification of threat signals.

The Cyber Security Strategy of Finland was adopted in 2013. The content of the strategy consists of four parts and annexes [24]: 1. Introduction. 2. Vision for cyber security. 3. Cyber security management and the national approach. 4. Strategic guidelines for cyber security. The strategy presents the vision, approach and strategic guidelines of cyber security. Unlike other strategies, this one establishes that cyber security is not exclusively a legal category, the adoption whereof would mean the conferral of new competences to institutions and other state establishments. Thus, this strategy is not aimed at creating new responsibilities and powers for the authorities.

The vision of Finland's cyber security is that Finland can secure its vital functions against cyber threats in all situations. Citizens, authorities and businesses can effectively utilize a safe cyber domain and the competence arising from cyber security measures, both nationally and internationally. Finland's strategy of 2013 is linked to the national information security strategy of 2008. It establishes that cyber security depends on efficient organization of information security. In other words, cyber security regulation is viewed holistically. Thus the implementation of cyber security is based on efficient and all-inclusive collection of information and the analysis thereof nationally and internationally. This is the only way in which comprehensive preparedness against cyber-attacks can be achieved. Good management of cyber security allocates responsibilities and functions among state authorities, private entities and the public. Cyber security must meet functional and technical requirements. The strategy mentions investments and trainings in research and development and the fact that Finland will contribute to these initiatives. By way of conclusion it might be stated that similar to the Estonian case, Finland emphasizes the element of continuity in drafting the strategy of 2013. The trend of moving from the level of fundamental provisions to a more strategic approach can be noticed in the comparison of both documents. However, unlike other countries, the new strategy of 2013 establishes that cyber security is not exclusively a legal category, thus this strategy is not aimed at creating new responsibilities and powers for the authorities.

Conclusions

The historical development analysis of cyber security strategies of all the countries above revealed one essential feature – the change of document provisions, which undoubtedly reflects the progress of cyber security in real life.

The strategies obviously have to reflect the real life situation (Rosenzweig, 2012). From our analysis of the different cyber security strategies, we have noticed several important trends.

At first, if the initial strategies talked about the formation of fundamental provisions, the second ones had a more specific focus, such as the presentation of policy and vision. The first strategies emphasized structures and the formation of a model of responsible authorities, while the second strategies focus on strategies and refinement of institutional responsibilities. The first strategies raised awareness of cyber security, while second strategies talk about the development of abilities in the cyber security area. The second strategies are more specific and most of them enclose specific action plans in the cyber security field.

The second, the analysis also revealed the importance of the global approach in cyber security phenomena. The majority of first strategies emphasized the cyber security capacity-building inside the country itself, while almost all the second strategies emphasize the building of capacities internationally. A particularly significant example of the current tendency is revealed in the analysis of the US strategy of 2011. While emphasizing the internationality of cyber security, the diplomatic goal of the US is to create initiatives and a common understanding of the international environment, which would work for the mutual benefit of cyber security. In so doing, the US assumes liability for cyber security of the entire international community.

The third, the consistency approach in building future cyber security strategies can be noted. Many second cyber security strategies emphasized the criterion of continuity. For example, since the Cyber Security Strategy of Estonia of 2008 was an advanced document, the second Cyber Security Strategy of 2014 distinguishes the emphasis on continuously developing confidence in cyber space. The US cyber security strategy of 2011 stresses the predictability of cyber security, which might be linked with the consistency approach.

The fourth, the planned specific deadlines for the implementation of the strategies can be distinguished herein as one of the progress indicators contained in the provisions of many second generation strategies themselves. Planned specific deadlines emphasize specific matters, certain actions and authorities responsible. Planned deadlines refer to the achievement of the results.

Acknowledgements

This article is part of the research 'Analysis and adaptation of EU and NATO cyber security strategies: Lithuanian cyber security model', funded by the Research Council of Lithuania (Grant No. MIP-099/2015/PRC-36).

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Darius Štūtilis is professor at the Mykolas Romeris University. He obtained PhD degree in law from Mykolas Romeris university in 2002 (the topic of Phd Thesis was related to the legal responsibility in cyberspace). He is the executive manager of master study program “Cyber security management” at Mykolas Romeris University. His research interests include IT law, cyber security law, privacy and personal data protection law, electronic identification law, cybercrime. He has over 40 publications primarily in the field of law and IT. Under his direction, he was involved in several scientific EU and national projects. Also, he is the co-author of two scientific monographs regarding identity theft in cyberspace: legal and electronic business issues, and e-health.

ORCID ID: orcid.org/0000-0002-9598-0712.

Paulius Pakutinskas is associated professor at the Mykolas Romeris University. He obtained PhD degree in law from Mykolas Romeris university in 2009 (the topic of Phd Thesis was related to the legal regulation of electronic communications). His research interests include IT law, intellectual property, cyber security. Also, he is the co-author of scientific monographs regarding identity theft in cyberspace: legal and electronic business issues.

Inga Malinauskaitė is a lecturer and PhD student at the Mykolas Romeris University. Her PhD topic is related to regulation and protection of data subject's rights in online social networks. Her research interests include data subject's rights, data protection in relation to IT systems, intellectual property, cyber security, online security issues.

ORCID ID: orcid.org/0000-0001-5693-7300

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ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

LEVEL AND SECTORS OF DIGITAL SHADOW ECONOMY: THE CASE OF LITHUANIA

Ligita Gasparėnienė¹, Rita Remeikienė², Alius Sadeckas³, Romualdas Ginevičius⁴

^{1,2} *Lithuanian Institute of Agrarian Economics, Address: V. Kudirkos str. 18-2, LT 03105, Vilnius, Lithuania*

³ *Mykolas Romeris University, Address: Ateities str. 20, LT 08303, Vilnius, Lithuania*

⁴ *Vilnius Gediminas Technical University, Address: Saulėtekio al. 11, LT-10223 Vilnius, Lithuania*

E-mails:¹ ligitagaspareniene@laei.lt; ² rita.remeikiene35@gmail.com; ³ alius@biuras.lt
⁴ romualdas.ginevicius@vgtu.lt

Received 20 June 2016; accepted 15 September 2016

Abstract. The fast pace of global computerization as well as the spread of online activities prompt the changes in the concept of shadow economy. Through cyberspaces, such as social networking platforms, alternative future currency systems, e-commerce, e-business systems or cyber computer games, real money (or an electronic equivalent of its value) circulates, but in most cases transactions are not accounted and do not generate taxes to the budget of a state. This article is aimed at supplementation of the traditional shadow economy estimation methodology with the indicator of digital shadow economy, and performance of the statistical analysis of the data which would allow to identify the areas with the highest scope of digital shadow economy. At present, the scope of shadow economy in Lithuania is estimated by employing one of the two methodologies – developed by the State Tax Inspectorate and by Lithuanian Free Market Institute. It should be noted that neither of these methodologies includes the elements of digital shadow economy. In theoretical level, no methodologies to cover any indicator of digital shadow economy with its relevant features have been developed so far. By employing the method of expert evaluation (with participation of 184 experts who work in the Department of Control, Lithuanian State Tax Inspectorate), the authors of this article initially estimated the scope of digital shadow economy and identified the areas with the highest scope of digital shadow economy in Lithuania over 2015. The research has revealed that more than a half of the experts have not inspected or identified any subjects illegally operating in e-space. The fact that the scopes of digital shadow economy have not still been estimated indeed burdens the development of any efficient mechanism, which would allow to identify and detect illegal economic activities in e-space.

Keywords: digital shadow economy, level of digital shadow economy, sectors of digital shadow economy, indicator of digital shadow economy, Lithuania

Reference to this paper should be made as follows: Ligita Gasparėnienė, L.; Remeikienė, R.; Sadeckas, A.; Ginevičius. 2016. Level and sectors of digital shadow economy: the case of Lithuania, *Entrepreneurship and Sustainability Issues* 4(2): 183-197.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(6\)](http://dx.doi.org/10.9770/jesi.2016.4.2(6))

JEL Classifications: E26, O17

1. Introduction

For the past two decades Information and Communication Technologies have penetrated every single area of the company (Hanclova *et al.*, 2015; Delina, Tkáč, 2015; Smaliukiene, Chi-Shiun & Sizovaite, 2015). In spite of the fact that internet economy facilitates exchange of products and services, it also leads to emergence of digital business and digital underground economy (Holz, Engelberth & Freiling, 2012). The spread of hardly defined economic activities online has become one of the most urgent problems in the field of economics over the last decade. According to Vlacho, Minou, Assimakopoulos and Toska (2011), the soaring revenues and profits generated by illegal business practices online cause serious threats not only for consumers who take a risk of purchasing illegal commodities, but also for the entire public sector and general welfare of the state. Regardless of the necessity to diminish and control the extent of digital shadow economy, no constant statistics of its scopes have been recorded either in local or international levels. Hence, the real size of digital shadow economy remains unestimated, and the perception of how digital shadow economy can be managed and prevented stays relatively vague, which has been confirmed by some scientific studies (Holt, Blevins & Burkert, 2010; Mayayise & Osunmakinde, 2014).

Thus far, the studies on the issue digital shadow economy have been aimed at comparison of traditional and digital shadow economies (Smith, 2015; Vlachos *et al.*, 2011), identification of the determinants of digital shadow consumption (Arli, Tjiptono & Porto, 2015; Camarero, Anton & Rodriguez, 2014; Mello, 2013; Taylor, 2012 and others.) and analysis of the issues that complicate the investigation of illegal activities in cyber space (Bossler & Holt, 2012; Swire, 2009; Wall & Williams, 2007). Yet the problem of the size of digital shadow economy has hardly been researched. Although the scopes of e-trade are soaring, and numerous areas of daily routines are being transferred to e-space (e-banking, e-books, exchange of goods in social networks, settlements in bitcoins, etc.), the scopes of digital shadow economy have not been estimated or separated from estimations of the scopes of traditional shadow economies. Absence of the reliable data on the scopes of digital shadow economy burdens estimation of the amounts of the revenue illegally earned in e-space, impedes assessment of the real volumes of this problem, and poses a significant challenge for law enforcement agencies to arrange its investigation and prevention.

The aim of this article – to supplement the traditional shadow economy estimation methodology with the indicator of digital shadow economy and to perform the statistical analysis of the data which would allow to identify the areas with the highest scope of digital shadow economy. To our knowledge, this type of scientific analysis has been conducted for the first time. For the fulfilment of the defined aim, the following **objectives** have been raised: 1) to analyse the theoretical literature on the concept of digital shadow economy and define its position in the context of traditional shadow economy; 2) to select and present the methodology of the research; 3) to introduce with the empirical results of the research. **The methods** of the research include systematic and comparative analysis of the scientific literature and expert evaluation.

2. The concept of digital shadow economy and its position in the context of traditional shadow economy

Scientific literature is rich in the variety of definitions and interpretations of the phenomenon of digital shadow economy. The analysis of the scientific literature has revealed that different authors define digital shadow economy considering its character (illegality), nature (operation online), purpose (economic or non-economic benefit) and the participants (consumers) involved. While defining digital shadow economy by its character, scholars interpret it as technologically advanced illegal activities online that cause serious threats for consumers, organisations and the public sector (Mello, 2013; Vlachos et al., 2011). What concerns the nature of digital shadow economy, the authors (Holz et al., 2012; Mayayise & Osunmakinde, 2014; Smith, 2015, etc.) note remote (Internet-based) conduction of unofficial activities. With regard to the key purpose of digital shadow activities, the concept of digital shadow economy is frequently aligned with the terms of digital underground economy, digital black market and e-fraud, respectively meaning the performance of profit-driven unregistered activities online (Herley & Florencio, 2010), generation of illegal revenues from online trade or service provision (Zorz, 2015), and the breach of the online-established contract (Hjort & Lantz, 2012) or the trust between the contract parties (Amasiatu & Shah, 2014). Finally, considering the role of consumers, digital shadow economy covers the terms of digital piracy and dysfunctional consumer behaviour online, respectively standing for the illegal or unauthorized copying/downloading of particular copyrighted content (Camarero et al., 2014; Castro, Bennett & Andes, 2009) and consumers' actions in the Internet that violate the generally accepted norms of conduct in trade (Harris & Daunt, 2011; Reynolds & Haris, 2009). Considering the position of digital shadow economy in the context of traditional shadow economy, some authors state that, similarly to traditional shadow economy, it is the wrong attitude to dissociate the former from grey economy since "it is a natural element of the economic/social life and should be considered in such a context" (Schneider, Raczkowski & Mroz, 2015: 35). In their study on shadow economy and tax evasion in the EU, Schneider et al. (2015) introduced the model of unofficial economy in the context of the whole economy. Following the model mentioned above, unofficial economy derives from four sectors of fundamental significance, i.e. agriculture, industry, services, and information and knowledge. However, the constituent of digital shadow economy is not included. With regard to significant contribution of digital shadow activities to the total scope of traditional shadow economy (according to the Government Accountability Office (GAO), various forms illegal activities online "cost the economy approximately \$117.5 billion each year" (2007: 3), this model can be expanded by incorporating the constituent of digital shadow economy (see Figure 1).

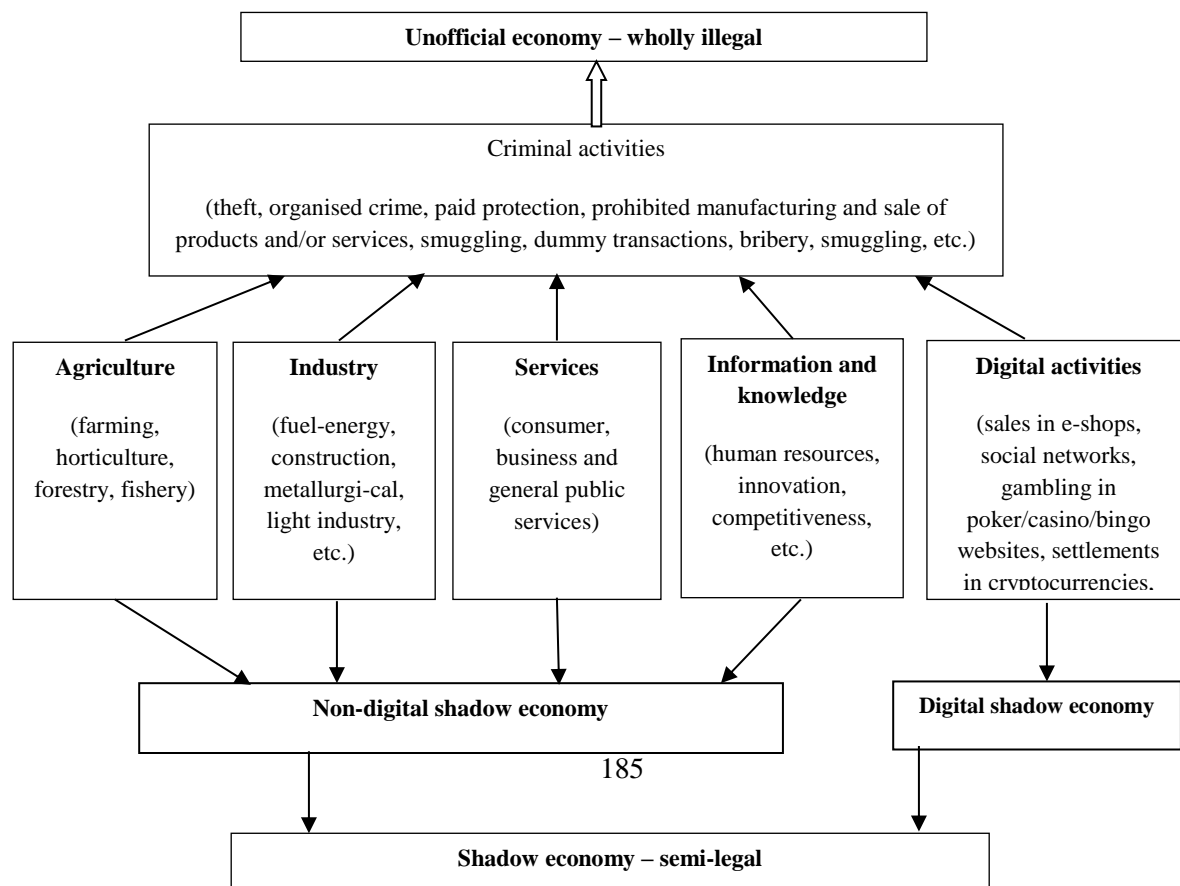


Fig.1. The position of digital shadow economy in the model of traditional shadow economy

Source: compiled by the authors with reference to Schneider et al., 2015.

Figure 1 shows that shadow (unofficial) economy (i.e. unregistered operations carried out by households, provision of services and production without registering/authorisation, permits, licences, and their inconsistent declaration, speculative transactions and insider trading) derives from five fundamental sectors (agriculture, industry, services, and information and knowledge sectors representing non-digital economy, and digital activities such as sales in e-shops with exceptionally electronic settlements, gambling in poker/casino/bingo websites, gaming in e-game websites, trade in social networks, settlements in bitcoins and other cryptocurrencies, etc. representing digital shadow economy), and the sector of digital shadow economy is ponderable as the one that provides the opportunities to create value without any geographical boundaries and minimize the information gap while undertaking the decisions of a transaction.

According to Bossler and Holt (2012), lack of a universally recognised concept of digital shadow economy as well as absence of the methodologies purposefully developed to estimate its size are acknowledged as the key hindrances that complicate investigation and prevention of illegal businesses online. Thus far, the studies on the issue of shadow economy estimation have covered the comparative analysis of different traditional shadow economy estimation methods (Georgiou, 2007; Schneider & Williams, 2013; Schneider et al., 2015), causal variables (Buehn & Schneider, 2012; Teobaldelli, 2011; Teobaldelli & Schneider, 2012) and results of the size of shadow economy obtained using different estimation methods (Pickhardt & Sarda Pons, 2006; Schneider, 2007; Schneider & Buehn, 2013; Schneider et al., 2015). Application of different traditional shadow economy estimation methodologies is based on consideration of a variety of shadow economy reflectors including monetary (denomination of bank notes, cash contribution ratio, currency ratio/demand), income and expenditure (GDP discrepancies, income/expenditure discrepancies, consumer expenditure), and non-monetary (electricity consumption data, the number of small and medium enterprises, employment (labour) discrepancies) ones (Buehn & Schneider, 2012; Georgiou, 2007; Schneider & Williams, 2013; Schneider et al., 2015 and others).

The most modern models of shadow economy estimation (for instance, MIMIC) consider such variables as direct taxation, indirect taxation and social security contribution, state regulation, tax morale, unemployment quota, GDP per capita, employment quota, average working time and change of local currency. According to Schneider and Buehn, it is based on “the statistical theory of unobserved variables, which considers multiple causes and multiple indicators of the phenomenon to be measured” (2013: 18). However, the variable of digital shadow economy is not considered as one of the unobserved variables. Hence, the analysis of the scientific literature proposes that the methods applied for estimation of the size of traditional shadow economy do not reflect the size of digital shadow economy, which determines the necessity to identify which share in the total estimations of traditional shadow economy is generated by digital shadow economy.

On balance, digital shadow economy refers to unregistered or illegal, trade or service provision related, profit-driven activities online. However, since the activities including cybercrime, digital piracy or e-fraud stand for criminal offences rather than economic operations, they should be distinguished from the concept of digital shadow economy and left for purely criminal consideration. Hence, digital shadow economy should be treated as online service provision or trade that is deliberately concealed from public authorities seeking for economic or non-economic

benefits. The analysis of the scientific literature has revealed that traditional methodologies of shadow economy estimation do not cover the indicators that would allow to estimate the level of digital shadow economy. For this reason, the aim of the empirical research is to establish plausible scopes of digital shadow economy and identify the sectors with the highest scopes of digital shadow economy in Lithuania over 2015.

Since to our knowledge this type of scientific analysis has been conducted for the first time, we employed the method of expert evaluation, and formulated the questions for the experts pursuing to obtain the information on their personal experience while detecting the cases of illegal activities in e-space. The methodology and results of the empirical research have been presented in the further sections of this article.

3. The methodology of the research

The analysis of the scientific literature has revealed that the scopes of traditional shadow economy are estimated by employing the variety of indicators, but the ones which reflect the size of digital shadow economy are not considered (see Figure 2).

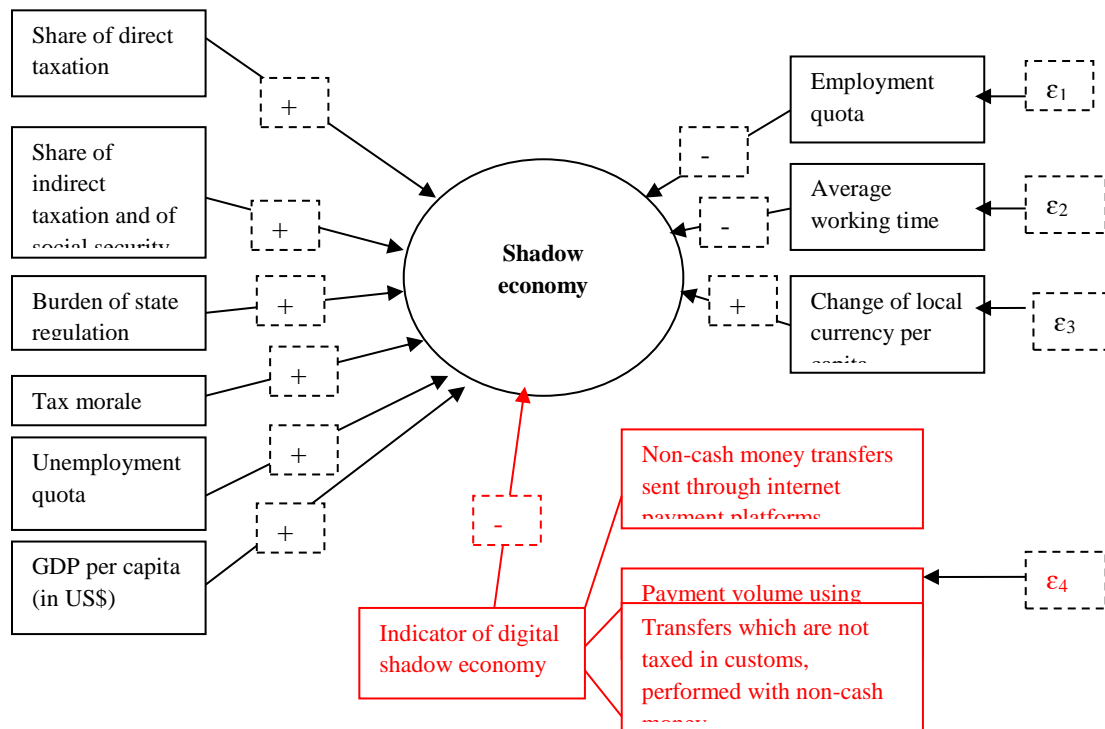


Fig.2. The variables of shadow economy estimation by MIMIC method updated with the indicator of digital shadow economy

Source: created by the authors with reference to Schneider et al., 2015.

After performance of the non-structural in-depth interviews with the heads of Lithuanian Department of Statistics and the Government of the Republic of Lithuania, the authors of this article propose to complement the MIMIC model, developed for estimation of the scopes of shadow economy, with the indicator of digital shadow economy that would be composed of non-cash transfers completed via online payment platforms like *MoneyGram*, *Paysera*, *Mokipay*, *Paypal* and others, frequency and amounts of payments in cryptocurrencies, and parcels delivered without custom duties (on the basis of non-cash transfers). During the interviews, the experts were asked to point out which

of the following statistical indicators could compose an indicator developed to estimate the scope of digital shadow economy:

- amounts of trade in cryptocurrencies, EUR;
- non-cash flows in online payment platforms, EUR;
- amounts of goods from the third countries seized in customs for the avoidance/unwillingness to pay duties, EUR;
- amounts of money won at online casinos, poker sites, etc.
- amounts of money won in e-games.

The interviews helped to find out that an indicator of digital shadow economy could be composed of several structural components (see Figure 2). In this research, the authors selected the method of expert evaluation for estimation of the scope of digital shadow economy in Lithuania. The research based on this method, has to involve 10 – 100 experts, considering the primary purpose of the research as well as the competence of the experts in the researched field (Augustinaitis et al. 2009). The expert evaluation was carried out applying an indirect method of data collection - a questionnaire survey; the questionnaire for the survey was prepared in advance. Apart from creativity, attitude towards the expertise, judgement flexibility, reliability, self-criticism and related qualities, scientific literature (Augustinaitis et al. 2009) emphasises the significance of expert competence.

Representatives of the Department of Control under the State Tax Inspectorate, who are responsible for business control and examination processes, were involved in the research as experts. Before completion of the questionnaire, we conducted a pilot survey on the current situation of digital shadow economy estimation and the proposed formulation of the questions for further research (representatives of the Parliament of the Republic of Lithuania, the Government of the Republic of Lithuania, Chamber of Audit and the Department of Support and Audit under the State Tax Inspectorate agreed to participate in the pilot survey). The pilot survey also enabled to formulate the concepts of “traditional shadow economy”, “digital shadow economy”, “e-space” and “the Internet”. Following the recommendations of the pilot survey experts, we familiarized the experts of the research introduced in this article with the concepts of “traditional shadow economy”, “digital shadow economy”, “e-space” and “the Internet”:

- traditional shadow economy refers to the processes ongoing in legally regulated markets, when these processes have a negative impact on state’s revenue from taxes and cover illegal activities performed with avoidance of tax obligations or aiming at other illegal benefits related to tax avoidance;
- digital shadow economy refers to illegal activities, such as digital service provision and sales of goods/services in the Internet, performing which entities violate existent legal norms and regulations with a pursuit of illegal mutual interest and material benefits, exceptionally exploiting digital space;
- the term of e-space is linked to the terms of “the Internet”, “cyberspace” and “electronic environment”. All these terms refer to the non-physical virtual space, which was created by employing IT. Such space enables direct (online) communication among the participants of the global market.
- the Internet refers to the “net of networks”, which combines huge quantities of computers all over the world and enables information exchange; exploitation of such network allows to significantly reduce communication costs for the people in different parts of the world. In the cyberspace, information can be transferred without any borders.

Analysis and interpretation of the research results. The questionnaire developed for this research consisted of 8 questions and was compiled by employing Google questionnaire creation tools. The first question enabled to establish in which Lithuanian district the largest part of the experts work. The second question - “How many cases, when physical entities performed economic activities in e-space without registration of these activities and without declaration of the revenues generated from these activities to the State Tax Inspectorate, did you detect over 2015?” - was included with the aim to disclose the plausible scope of digital shadow economy which was captured during the inspections. The third question – “How many cases, when physical entities who have officially registered a

traditional business, but at the same time run a business in e-space and hide the revenues earned from the latter, did you detect over 2015?” – was included in order to specify the plausible scope of digital shadow economy in the country over the researched period (we included this question following the recommendations of the pilot survey experts, who noted that entities may conduct shadow e-business alongside with an officially-registered traditional business). The fourth and fifth questions enabled to identify the sectors with the highest scopes of digital shadow economy in Lithuania over 2015. The other questions were included with the aim to obtain the plausible numerical estimation of unaccounted revenues earned in e-space in the country over the researched period and to identify the e-space objects that commonly lie under control of the State Tax Inspectorate of the Republic of Lithuania. The experts were asked to evaluate each of the statements in Likert evaluation scale, where rank 1 stands for the lowest (I completely disagree/it is completely insignificant), and rank 5 – for the highest possible evaluation (I completely agree/it is extremely significant). In accordance with the strength of agreement/disagreement with a particular statement, intermediate ranks 2, 3 or 4 could be selected.

The results of the research were processed with SSPS (Statistical Package for Social Sciences) and Microsoft Excel software. The generalized rank values have been presented in Table 1.

Table 1. Matrix of the expert evaluation results on digital shadow economy concept, features and channels

Experts	Variables (V)					
	1	2	...	i	...	N
1	V_{11}	V_{12}	...	V_{1i}	...	V_{1n}
2	V_{21}	V_{22}	...	V_{2i}	...	V_{2n}
...
J	V_{j1}	V_{j2}	...	V_{ji}	...	V_{jn}
...
M	V_{m1}	V_{m2}	...	V_{mi}	...	V_{mn}
Rank sum						
Kendall's coefficient of concordance, W						
p-value						
Frequency of feature indication						

In Table 1, value V_{jn} reflects the level of significance, which was attributed to statement n by expert j . By employing the introduced matrix, rank sum V_i for statement i as well as rank sum S_i average \bar{s} for statement i were estimated, and significance of each of the statements alongside with compatibility of the experts' opinions (expressed as Kendall's coefficient of concordance W) were established. Variability of Kendall's coefficient of concordance falls into the interval $0 \leq W \leq 1$, which means that the values of the coefficient close to 1 show high compatibility of the experts' opinions. When $W \leq 0.6$, compatibility of the expert evaluation results is considered weak, but if $p < 0.05$, the data can be treated as reliable.

When introducing the results of the expert evaluation, special attention should be drawn to interpretation of *Cronbach alpha* coefficient. Some scientists, e.g. Nunnally and Bernstein (1994), point out that *Cronbach alpha* coefficient must be higher than 0.7. The research was conducted by the Internet over January and February, 2016. 184 experts participated in the research. The results of the research were processed by employing *SSPS* and *Microsoft Excel* software.

4. The results of the empirical research: the scope of digital shadow economy in Lithuania

Systematisation of the research results has disclosed that the experts working in Vilnius and Kaunas Departments of Control under the State Tax Inspectorate of the Republic of Lithuania composed the largest part of the total number of the respondents (respectively 31.7 and 25.7 percent). Active involvement of the experts from the above-

mentioned Lithuanian cities must have been determined by the largest overall population in these cities. The share of the experts working in Siauliai and Panevezys Departments of Control under the State Tax Inspectorate composed respectively 18.6 and 17.5 percent (see Figure 3).

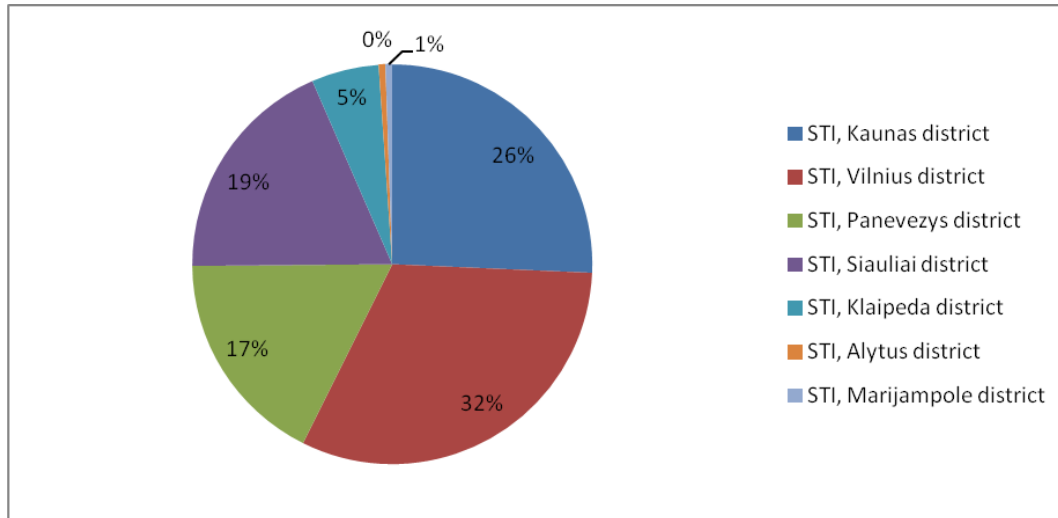


Fig.3. Distribution of the experts by geographical region

Source: Compiled by the authors with reference to the research results.

Further in the survey, the experts answered the questions which were included in order to estimate the scope of shadow economy in Lithuania over 2015. The data in Table 1 show that more than a half of the experts (i.e. 52.6 percent of the total number of the respondents) have never checked or received an order to check the subjects who constantly operate in e-space without declaration of their revenues to the State Tax Inspectorate.

Table 2. Estimation of the scope of digital shadow economy

Question	Substantiation
1) How many cases, when physical entities performed economic activities in e-space without registration of these activities and without declaration of the revenues generated from these activities to the State Tax Inspectorate, did you detect over 2015?	36.6 percent of the experts marked that they had detected up to 2 percent of the total number of traditional shadow economy cases, when physical entities performed economic activities in e-space without registration of these activities and without declaration of the revenues generated from these activities to the State Tax Inspectorate. Insignificant number of the experts (from 1 to 6 people) indicated that the cases of digital shadow economy make 2-11 percent of the total number of traditional shadow economy cases. Note: 52.6 percent of the experts selected the answer alternative “Others”, and substantiated their selection with such reasons as absence of the orders to check economic activities performed by physical entities in e-space over 2015; the cases of digital shadow economy were not detected because the experts did not face such cases; the period of 2015 was indicated as non-reference period.
2) How many cases, when physical entities who have officially registered a traditional business, but at the same time run a business in e-space and hide the revenues earned from the latter, did you detect over 2015?	33.6 percent of the experts marked that, in the total number of shadow economy cases, they had detected up to 2 percent of the cases when physical entities who have officially registered a traditional business, but at the same time run a business in e-space and hide the revenues earned from the latter. Insignificant number of the experts (1-4 people) noted that this percentage could compose 2-11 percent in the total number of shadow economy cases.

	Note: 53.9 percent of the experts selected the answer alternative “Others”, and substantiated their selection with such reasons as “the expert did not face such cases” and “no control procedures in e-space took place over 2015”.
3) How many cases, when physical entities ran a traditional business without registration of this business and without declaration of the revenues generated from this business to the State Tax Inspectorate, did you detect over 2015?	41.3 percent of the experts marked that, in the total number of shadow economy cases, they had detected up to 2 percent of the cases when physical entities ran a traditional business without registration of this business and without declaration of the revenues generated from this business to the State Tax Inspectorate. 8.4 percent of the experts detected 2-4 percent of such cases, 5.6 percent of the experts – 4-6 percent of such cases; and 3 percent of the experts – 6-11 percent of such cases. Note: 39.9 percent of the experts selected the answer alternative “Others”, and substantiated their selection with such reasons as “the expert did not face such cases” and “the period of 2015 was considered a non-reference period”.

Source: compiled by the authors with reference to the results of the expert evaluation.

The rest part of the experts (36.6 percent of the total number of the respondents) indicated that they had detected up to 2 percent of the total number of shadow economy cases in e-space.

Further in the research, we asked the experts to note whether they had dealt with the cases when a person had officially registered a traditional business, but at the same time runs business in e-space and hides the revenues earned from the latter. The research has disclosed that 53.9 percent of the experts have never faced this problem, and 2015 was not a reference year of control; 33.6 percent of the experts have detected up to 2 percent of entrepreneurs who hide their revenues earned from business in e-space.

In order to obtain the numerical value of the scope of digital shadow economy (million euros) in Lithuania, we asked the experts to indicate the plausible scope of unaccounted revenues generated in e-space over 2015 (see Figure 4).

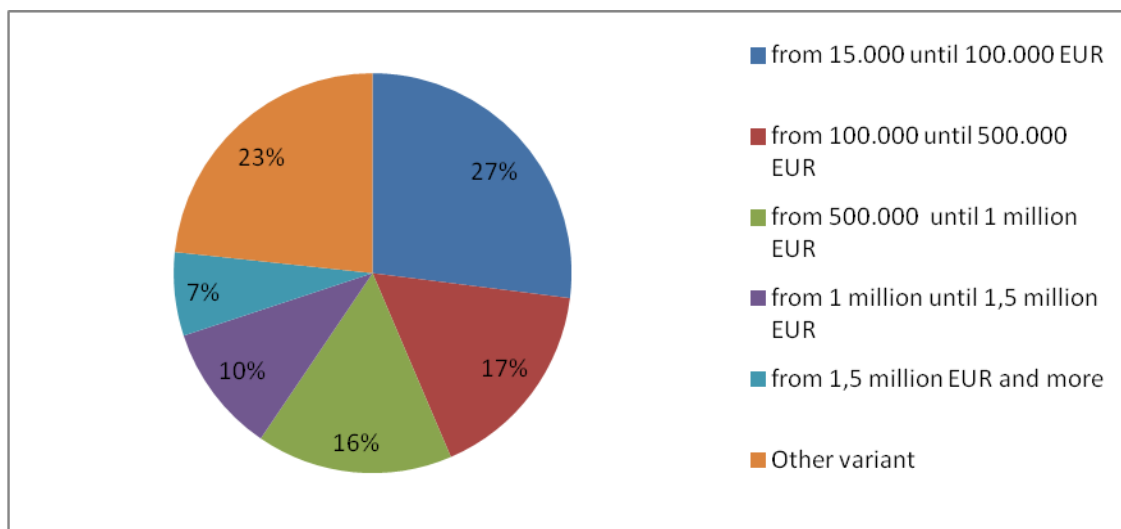


Fig.4. The numerical value of the plausible scope of digital shadow economy in Lithuania over 2015, million euros

Source: compiled by the authors with reference to the research results.

The data in Figure 3 show that distribution of plausible scopes of unaccounted revenues, generated in e-space over 2015, is nearly equal for all the scope intervals, i.e. the plausible scope of digital shadow economy in Lithuania over 2015 varies from 15 thousand to 1.5 million euros and more. Nevertheless, the majority of the experts noted that

the plausible scopes of digital shadow economy in Lithuania over the researched period might vary from 15 to 100 thousand euros.

Alongside with the plausible scope of digital shadow economy, we attempted to identify the areas of economic activities (by Lithuanian Classification of Economic Activities *EVRK 2*) with the highest scopes of undeclared revenues generated in e-space. The value of Cronbach alpha coefficient equal to 0.82 shows that the questions presented to the experts reflect the researched dimension with appropriate accuracy. The value of Kendall's coefficient of concordance is equal to 0.122, but value p equal to 0.000 refers to statistically significant answers, although compatibility of the experts' opinions is weak. We consider an economic activity significant if its mean rank is equal to or higher than 3.5 points (see Figure 5).

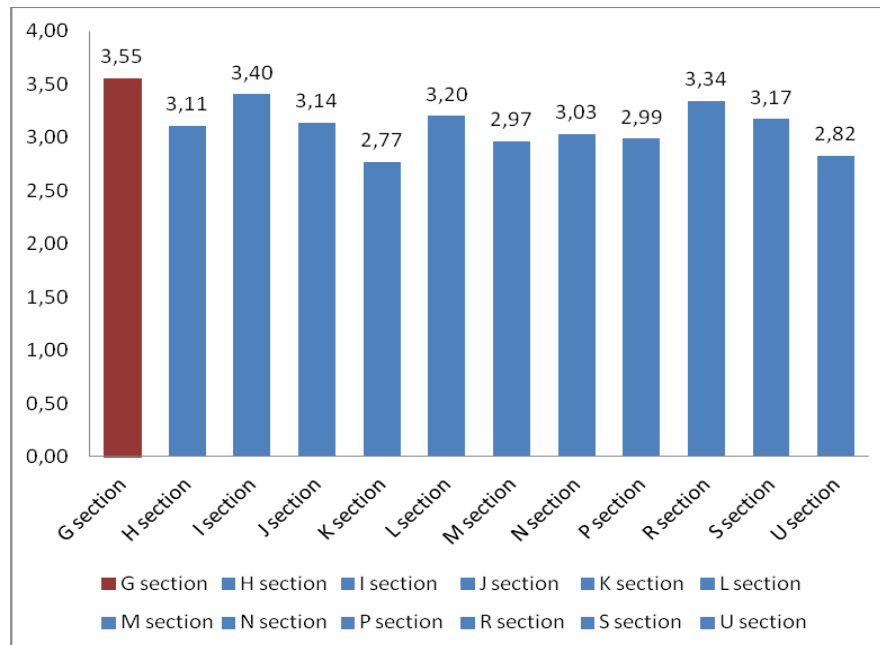


Fig.5. Experts' position on the areas of economic activities with the highest scopes of undeclared revenues generated in e-space

Source: compiled by the authors with reference to the research results.

The data presented in Figure 4 show that section G - wholesale and retail; repair of motor vehicles and motorcycles – is the only section with captured cases of digital shadow economy (mean rank is equal to 3.5). Mean ranks estimated for the other sections of economic activities range around 3, which proposes that either the cases of digital shadow economy in these sections have not been captured or the scopes of digital shadow economy are insignificant there.

Further in the research, we asked the experts to indicate the types of products/services which are illegally traded in each of the sections to earn unaccounted revenue in e-space. With reference to the research results, we can distinguish the following types of such products/services:

- Car trade and services (vehicle trade, car parts, transportation services, taxi services);
- Services of construction sector (rent of premises, accommodation services, real estate rent);
- Catering (food preparation, bakery (cakes), food delivery to different types of events);
- Trade in clothing, footwear, domestic electric appliances, electronic devices, perfumery, cosmetics, food supplements, energy resources to physical entities (wood, wood pellets), timber, building materials;
- Education services (assistance with preparation of reference papers, diploma works, tutorial services, language teaching, informal education circles);

- Beauty and entertainment services (massages, beauty services, rest and recreation arrangement services, travel arrangement);
- Advertisement services, administration of websites.

The research results have also revealed which e-space objects commonly lie under control of the State Tax Inspectorate of the Republic of Lithuania (see Figure 6).

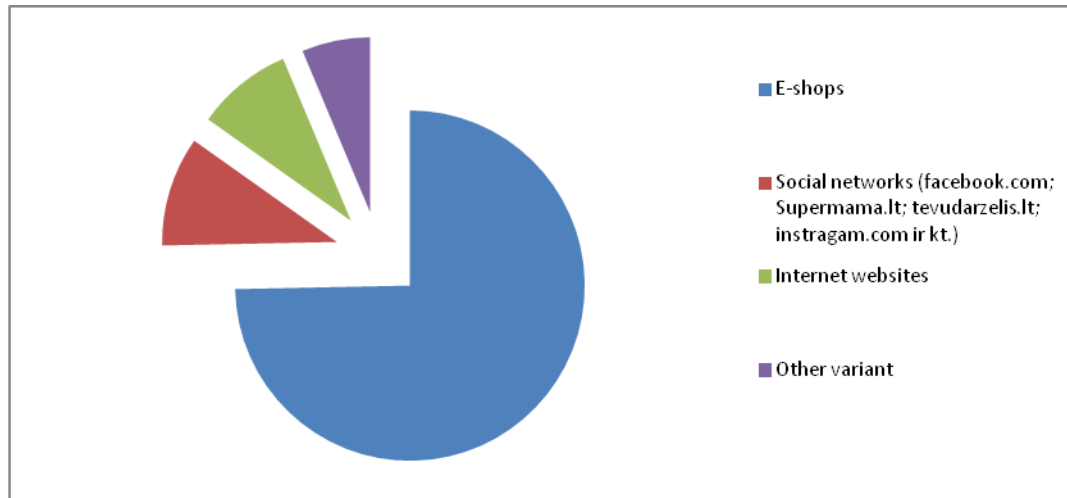


Fig.6. E-space objects which commonly lie under control of the State Tax Inspectorate, percent

Source: compiled by the authors with reference to the research results.

The data presented in Figure 6 show that e-shops are the objects that most commonly lie under control of the State Tax Inspectorate of the Republic of Lithuania, as it was noted by 74.7 percent of the experts. 10.1 percent of the experts control social networks, and 8.9 percent of the experts – internet websites.

The results of the research lead to the following conclusions:

- 1) Estimation of the scope of digital shadow economy is a topical issue of economics and tax evasion not only in Lithuania, but also in other Eastern EU Member-States, and no clear strategic guidelines have been defined to solve this problem. We make this conclusion with reference to the research results, which have revealed that over the year 2015, more than a half (52.6 percent) of the experts did not check or receive an order to check the subjects who constantly operate in e-space without declaration of their revenues to the State Tax Inspectorate. Also, 53.9 percent of the experts admitted having never dealt with the cases when a person has officially registered a traditional business, but at the same time runs business in e-space and hides the revenues earned from the latter. This proposes that the Department of Control under the State Tax Inspectorate of the Republic of Lithuania either do not possess sufficient human and financial resources to detect the cases of illegal economic activities in e-space or do not have any efficient mechanisms which would enable to do it. Hence, the improvement of the situation calls for the development of additional competences and skills in IT and law areas, and raises the necessity to attract extra funding for acquisition of the software which would allow to detect and identify illegal economic activities (operations) in e-space.
- 2) The results of the expert evaluation have disclosed that authorized officials detected up to 2 percent of the total number of shadow economy cases in e-space in Lithuania over 2015. The areas of economic activities with the highest scopes of undeclared revenues generated in e-space cover wholesale and retail, and repair of motor vehicles and motorcycles (mean rank is equal to 3.5). The types of products/services which are illegally traded in each of the sections to earn unaccounted revenue in e-space include real estate rent and sales, education and catering services, trade in clothing, vehicles and electronic devices. The plausible scope of digital shadow economy in Lithuania over 2015 varies from 15 thousand to 1.5 million euros and more,

which shows that deviation of the plausible numerical value of the scope of digital shadow economy in the country is extremely high.

- 3) The objects that most commonly lie under control of the State Tax Inspectorate of the Republic of Lithuania include e-shops, while social networks and internet websites are controlled to the smallest extent, which proposes that they make the most favourable environment for the development of digital shadow economy.
- 4) The methodologies aimed at estimation of the scope of digital shadow economy have not been developed; the Department of Control under the State Tax Inspectorate of the Republic of Lithuania attribute the identified cases of digital shadow economy to the total number of the cases of shadow economy in the country. Due to this reason, it is difficult to capture the true data on the scopes and trends of digital shadow economy. Hence, inclusion of the indicators of digital shadow economy in the methodologies of shadow economy estimation would enable to obtain the data on the real volumes of this phenomenon and would contribute to the development of the measures aimed at digital shadow economy detection and prevention.

Summary and conclusions

The analysis of the scientific literature has revealed that digital shadow economy refers to unregistered or illegal, trade or service provision related and profit-driven activities online. However, considering the offensive nature of such activities as cybercrime, digital piracy or e-fraud, they should be distinguished from the concept of digital shadow economy and left for purely criminal consideration. Hence, digital shadow economy should be treated as online service provision or trade that is deliberately concealed from public authorities seeking for economic or non-economic benefits.

The analysis of the scientific literature has also disclosed that traditional methodologies of shadow economy estimation do not cover the indicators that would allow to estimate the level of digital shadow economy, which determines the necessity to identify which share in the total estimations of traditional shadow economy is generated by digital shadow economy. The improved model of shadow economy estimation (based on the MIMIC model) that covers the indicator of digital shadow economy requiring additional statistics, which are not accumulated in traditional statistical databases, is a contribution to the development of the theory of shadow economy. Since to our knowledge this type of scientific analysis has been conducted for the first time, we employed the method of expert evaluation for the empirical research.

The empirical research, based on the method of expert evaluation, has enabled to establish the plausible scopes of digital shadow economy and identify the areas of economic activities with the highest scopes of undeclared revenues in Lithuania. With reference to the empirical research, the following conclusions can be made:

1. The scopes of digital shadow economy are not captured or estimated separately from the scopes of traditional shadow economy. The majority of the authorized officials from the Department of Control under the State Tax Inspectorate of the Republic of Lithuania do not check or receive an order to check the subjects who constantly operate in e-space without declaration of their revenues to the State Tax Inspectorate, and do not deal with the cases when a person has officially registered a traditional business, but at the same time runs business in e-space and hides the revenues earned from the latter. These findings propose that the institutions authorised to deal with the cases of shadow economy do not possess sufficient human and financial resources to detect the cases of illegal economic activities in e-space or do not have any efficient mechanisms which would enable to do it. Hence, estimation of the scope of digital shadow economy remains a topical issue of economics and tax evasion, and the improvement of the situation calls for the development of additional competences and skills in IT and law areas, and raises the necessity to attract extra funding for acquisition of the software which would allow to detect and identify illegal economic activities (operations) in e-space.

2. The plausible scope of digital shadow economy in Lithuania over 2015 varies from 15 thousand to 1.5 million euros and more, which shows that deviation of the plausible numerical value of the scope of digital shadow economy in the country is extremely high, although the majority of the experts note that the plausible scopes of digital shadow economy in Lithuania over the researched period may vary from 15 to 100 thousand euros.
3. The areas of economic activities with the highest scopes of undeclared revenues generated in e-space cover wholesale and retail, and repair of motor vehicles and motorcycles (mean rank is equal to 3.5). The types of products/services which are illegally traded in each of the sections to earn unaccounted revenue in e-space include real estate rent and sales, education and catering services, trade in clothing, vehicles and electronic devices.

On balance, we can state that attribution of the figures of digital shadow economy to the total estimations of shadow economy impedes capturing the real data on the scopes and trends of digital shadow economy. Hence, inclusion of the indicators of digital shadow economy in the methodologies of shadow economy estimation would enable to obtain the data on the real volumes of this phenomenon and would contribute to the development of the measures aimed at digital shadow economy detection and prevention.

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Prof. Dr. Ligita GASPARĖNIENĖ links her research fields to the analysis of macroeconomic phenomenon's, practical decisions of outsourcing and estimation of shadow economy. In 2009, she defended the doctoral thesis on the topic "The impact on transaction costs on outsourcing contracts" (the field of economics, social sciences). During the period of 2005-2015, the researcher has published over 40 scientific articles and issued two monographs titled "The methodology of the estimation of external service transaction costs" and "Estimation of financial investment and investment projects". The basic fields of her scientific work include transaction costs, shadow economy, real estate economy. Ligita Gasparėnienė participated in 3 chartered national projects and is currently involved in the scientific national (Lithuanian) project "Digital shadow economy" as the principal researcher.

ORCID ID 0000-0002-5535-6552

Assoc. Prof. Dr. Rita REMEIKIENĖ has accumulated much scientific experience in the research of self-employment and business environment conditions in transition economies. In 2012, she defended the doctoral thesis on the topic "The factors of self-employment in transition economies" (the field of economics, social sciences), which won Lithuanian Science Council's award for the best research in the field social sciences. During her scientific career, Rita Remeikienė has prepared and published over 40 scientific articles (6 of which were included in ISI basic list issues; 7 – in ISI database referred issues; 14 – in international databases referred issues, etc.). The main topics of the research are linked to the issues of expansion of opportunities in the labour market, shadow economy, outsourcing, gender gaps, and entrepreneurship. Previously, Rita Remeikienė participated in 3 chartered national projects and led the study project "Nord Plus Horizontals". At present, she is leading the scientific national (Lithuanian) project "Digital shadow economy".

ORCHID ID: 0000-0002-3369-485X

Alius SADECKAS is researcher (PhD student) at Mykolas Romeris University. Research interests: organization theory, complex, quantitative evaluation of social processes and phenomena; economic systems, shadow economy.

Prof. dr. habil. Romualdas GINEVIČIUS is the head of Department of Enterprise Economics and Management, construction engineer and economist. The author of more than 350 research papers and over 20 scientific books; Editor-in-Chief of the „Journal of Business Economics and Management“ (Thomson Reuters, "Web of Science") and the journal „Business: Theory and Practice“ (SCOPUS). Research interests: organization theory, complex, quantitative evaluation of social processes and phenomena.



ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

**HOUSEHOLD INCOME AND SATISFACTION WITH LIFE:
COGNITIVE – EMOTIONAL IMPACT PARADOX^{6*}**

Aiste Dirzytė¹, Ona Gražina Rakauskienė², Vaida Servetkienė³

^{1,2,3} *Mykolas Romeris University, Ateities str. 20, LT 08303 Vilnius, Lithuania*

E-mails: aiste.dirzyte@gmail.com; ona.rakaus@gmail.com; vaida@mruni.eu

Received 20 July, 2016; accepted 25 September 2016

Abstract. Much of the discussion over satisfaction with life has focused on the significance of income. Some researchers argue that cognitive factors (expectations, social comparisons, life evaluations, schemas) is the mediating part between income and subjective wellbeing, however, positive psychology suggests that happiness determines the effect of social comparison itself. This paradox could be titled “cognitive - emotional impact paradox”. We have chosen to explore this paradox and investigate the relationship between household income, cognitions, emotions, and satisfaction with life in Lithuania, as various studies, including “World Value Survey”, indicate Lithuania is among the countries demonstrating very low scores on happiness of population even though its’ economy grew fast when this country regained its’ independence in 1991. This paper presents some results of the survey which was conducted in 2016 (representative sample, n=1001). The analysis of data has demonstrated that when people get low household income per month, they report more intense negative emotions and less positive emotions. Secondly, our results suggest that people getting low household income per month express more negative cognitions and less positive cognitions. Thirdly, the results demonstrated strong relationship between cognitions, emotions, and satisfaction with life. Moreover, the results contribute to the empirical literature on “income – happiness” relation by demonstrating that household income has no significant direct effect on satisfaction with life, but there is a significant effect of household income on basic cognitions, which have a significant effect on emotions. Subsequently, basic cognitions and emotions have an effect on satisfaction with life. However, “cognitive – emotional impact paradox” needs further exploration.

This research is funded by the Research Council of Lithuania (No. GER-009/2015).

Keywords: household income, subjective wellbeing, happiness, Lithuania

^{*} *This work was supported by the Research Council of Lithuania [grant number GER-009/2015]*

Reference to this paper should be made as follows: Dirzytė, A.; Rakauskienė, O.G.; Servetkienė, V. 2016. Household income and satisfaction with life: cognitive – emotional impact paradox, *Entrepreneurship and Sustainability Issues* 4(2): 198-210.
DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(7\)](http://dx.doi.org/10.9770/jesi.2016.4.2(7))

JEL Classifications: D63; A14; I31; R20

1. Introduction

In cognitive therapy, which is the most widely applied intervention to enhance subjective wellbeing, there is a central premise that cognitions (thoughts, beliefs, personal constructs, cognitive schemas, expectations) give rise to emotions (Beck, 2014). In other words, emotions are consequence of certain cognitions. Negative cognitions like “life is meaningless” might result in emotions like sadness and despair, while positive cognitions like “we are created like this” (Yalom, 1989) might result in emotional relief, peacefulness and even happiness.

Currently, researchers have been envisaging emotions as constituent of wellbeing. In methodological recommendations of assessing psychological wellbeing, it is suggested to evaluate person’s positive and negative emotions (emotional component), and not just focus on satisfaction with life (cognitive component).

Moreover, it is supposed that happiness as emotion might contribute to various behavioral and health consequences. For example, it was found that happiness promotes multiple successful life outcomes, including superior health, higher income, stronger relationships (Lyubomirsky, King & Diener, 2005).

Recent research shows differences in cognitions of happy and unhappy people: happy and unhappy individuals differ considerably in their subjective experience and construal of the world (Lyubomirsky, 2001). Besides, happy people have been found to use a positive perspective when evaluating themselves and others (Lyubomirsky & Tucker, 1998); they also tend to judge almost everything about themselves and their lives favorably, including their friendships, recreation, self-esteem, energy levels, and purpose in life (Lyubomirsky, Tkach, et al., 2006).

Furthermore, research has also showed that the self-perceptions of happy individuals are relatively invulnerable to social comparisons (Boehm & Lyubomirsky, 2009), happy people’s emotions and self-regard are much less impacted by comparisons with others than those of unhappy persons (Boehm & Lyubomirsky, 2009), unhappy people are more responsive to both group and individual information, particularly in “failure” situations (Boehm & Lyubomirsky, 2009), unhappy people engage in negative and maladaptive dwelling more so than do happy people, and their excessive dwelling not only makes them feel bad, but brings about significant detrimental outcomes (Lyubomirsky & Kasri, 2006), happy people are relatively more likely to report endowing past positive life experiences and contrasting negative life experiences (i.e., considering how much better off they are today), whereas unhappy people are relatively more likely to report ruminating about negative experiences and contrasting positive experiences (i.e., considering how much worse off they are today) (Lieberman et al., 2008).

Moreover, emotions were found to be related to satisfaction or dissatisfaction with different aspects of life: happy people tend to be more satisfied with all of their available options (including the option they eventually choose) and only express dissatisfaction in situations when their sense of self is threatened (Boehm & Lyubomirsky, 2009). In one interesting study people were asked to rate the attractiveness of several desserts, and they increased their liking for the dessert they got and didn’t change their liking for the dessert they couldn’t get, while unhappy people found the option they were given to be minimally acceptable (derogating that dessert after learning they could keep it) (Lyubomirsky & Ross, 1999). In another study, after being accepted by individual colleges, happy people boosted their liking and judgments of those colleges (Lyubomirsky et al., 2005). These findings suggest that “happy people’s strategies of processing life events serve to prolong and preserve positive emotions, whereas the strategies of unhappy individuals serve to dampen the inherent positivity associated with positive events and to enhance the negative affect associated with negative events” (Boehm & Lyubomirsky, 2009).

How these positive psychology findings might be applied to economic psychology? The well-known scholar of economic psychology R. A. Easterlin, who has created the famous “Easterlin income-happiness paradox” (2001) argued that more income should bring greater happiness; nevertheless, aspirations grow along with income. In other words, money does not bring happiness as certain expectations prevent that. This conclusion is absolutely true from the point of cognitive therapy. However, if we keep the notion that merely cognitions (expectations) explain whether a person is happier or not, then what is the meaning of economic psychology? Wouldn’t it be better to explore the cognitive profile of a happy person in all income groups, and then let cognitive therapists do their work to increase happiness of societies?

Some research suggests it wouldn’t be better: income still matters for happiness. For example, Ball, R., & Chernova, K. (2008) used data from the World Values Survey to investigate how an individual’s self-reported happiness is related to the level of income in absolute terms, and the level of income relative to other people in the country. They found that “both absolute and relative incomes are positively and significantly correlated with happiness, quantitatively, changes in relative income have much larger effects on happiness than do changes in absolute income, and the effects on happiness of both absolute and relative income are small when compared to the effects several non-economic factors” (Ball, Chernova, 2008).

Nonetheless, some researchers still refer to the importance of cognitive factors in income-happiness relationship. Greve, B. (2012) reasoned that, “in general, countries with a higher income per capita have higher levels of happiness; nevertheless, as Easterlin has observed, an increase in income is not necessarily correlated with an increase in happiness. Based upon recent data from the European Social Survey, Greve has tried to fill this gap by looking at changes in happiness in the wake of the recent financial crisis and consequent change in income as measured by gross domestic product per capita. However, the data for 15 European countries suggested that such a causal relationship cannot be confirmed on the basis of the present limited data” (Greve, 2012). Likewise, Becchetti, L., Corrado, L., & Rossetti, F. (2011) argued that “the standard money-happiness relationship provides a partial and incomplete picture of the complex connection between happiness and income as it does not take into account the role of peers and of reference group income and that of the dynamics between realizations and expectations” (Becchetti, Corrado, & Rossetti, 2011).

Many researchers refer to the importance of social comparison in income- happiness relationships (but already from the findings of Lyubomirsky we know that it matters just for unhappy people). Guven, C., & Sørensen, B. (2012) found that “reference group income negatively relates to own happiness and high perceptions about own relative income, quality of dwelling and social class relate positively and very significantly to happiness. Perceptions about income and status are more significant for females, and for low income, conservative, more social, and less trusting individuals. Dwelling perceptions matter more for males, and for middle income, married, conservative, more social, and less trusting individuals” (Guyen & Sørensen, 2012).

Interestingly, Clark, A. E., Frijters, P., & Shields, M. A. (2008) reasoned that income may be evaluated in relation to others (social comparison) or to oneself in the past (habituation). They reviewed the evidence on relative income from the subjective well-being literature, and concluded that “taking relative income seriously is an important step toward greater behavioral realism in Economics, such that models and empirical analysis move closer to how real people feel and behave. They concluded that utility functions including relative income terms produce a wide variety of testable predictions regarding both well-being (measured by survey or neurologically) and observable behaviors: it is not true that “anything goes.” Clark, Frijters, & Shields argue “there is need to appeal to both direct measures of utility and observed behavior in order to obtain a better idea of what the utility function looks like, and make policy recommendations in the best interest of society” (Clark, Frijters, Shields, 2008). Remarkably, Gundlach, E., & Opfinger, M. (2013) analyzed some applications of basic utility theory. Researchers found a positive correlation

between happiness and religiosity, a positive correlation between happiness and income, and a negative correlation between religiosity and income (Gundlach, Opfinger, 2013).

What are the results of the other recent studies on income-happiness relationship and the related factors? They are multiple and multivariate. Bruni L., & Stanca L. (2006) offered an alternative explanation of Easterlin's income happiness paradox: "television viewing in contemporary society, by raising material aspirations, contributes to offset the effect of higher income on individual happiness" (Bruni & Stanca, 2006, p. 225).

However, Schneider, L. (2013) has demonstrated that there is no significant, positive and robust impact of TV consumption on material aspirations, even though this hypothesis cannot be totally disapproved, and suggested applying a more direct approach of measuring the effect of TV on material aspirations (Schneider, 2013). Budria, S. (2013) claimed that relative income effects cannot be regarded as constant across the subjective wellbeing distribution, and that the results are consistent with previous findings as they show that happy individuals are particularly successful at defending themselves against the potentially negative hedonic consequences of unfavorable comparisons and in using social comparison information strategically to increase their subjective wellbeing, while unhappy individuals tend to interpret unfavorable social comparison information more pessimistically or to focus on their negative aspects (Budria, 2013).

Cullis, J., Hudson, J., & Jones, P. (2011) confirmed the importance for happiness of relative income, average standard of living, marital status and age (Cullis, Hudson, & Jones, 2011). Fischer, C. S. (2008) revealed a modest but real correlation between material well-being and national happiness (Fischer, 2008). Gleibs, I. H., Morton, T. A., Rabinovich, A., Haslam, S. A., & Helliwell, J. F. (2013) showed that both money (individual income) and community (social capital) can be the basis for individual happiness, however, the relative influence of each factor depends on the context within which happiness is considered, and how this shapes the way people define the self (Gleibs et al., 2013). Headey, B., Muffels, R., & Wooden, M. (2008) found that happiness is considerably more affected by economic circumstances than previously believed: wealth affects life satisfaction more than income (Headey, Muffels & Wooden, 2008). Powdthavee, N. (2010) suggested money buys little happiness, and a reevaluation on how the calculation of compensatory packages to various shocks in the individual's life events should be designed (Powdthavee, 2010). Roszkowski, M. J., & Grable, J. (2007) demonstrated surprisingly weak correlation between money and happiness: they found that net worth is a stronger correlate of satisfaction with one's financial situation than is household income, but they could not demonstrate that net worth is also more strongly associated with happiness with life in general (Roszkowski, & Grable, 2007). Zuzanek, J. (2013) found that higher household income correlate positively with respondents' retrospective assessments of life satisfaction, but economic growth has not been accompanied by a corresponding rise of subjective wellbeing (Zuzanek, 2013).

Zhang, H., & Tsang, S. (2013) found that "a woman married to a husband with lower income tended to be less happy with her marriage, but hopefully, this effect could be countered if there is more love in the sense of a genuine concern about the well-being of the partner and a willing to make sacrifice for him" (Zhang & Tsang, 2013). Some findings look questionable: Kuroki, M. (2013) has even concluded that "happiness of the wealthy, which can afford to lose some money as well as buy some safety, is not affected by the direct experience of burglary or robbery"! (Kuroki, 2013). This conclusion could be highly doubted from the perspective of trauma psychology.

To sum up, there is a variety of studies which suggests that this field needs additional exploration, as there are lots of contradictions and paradoxes. It could be concluded that cognitive factors (expectations, social comparisons, life evaluations, schemas) is the mediating part between income and happiness, however, positive psychology suggests that happiness determines the effect of social comparison itself! This paradox could be named "cognitive - emotional impact paradox". Even though cognitive therapy model clearly points out to the primary role of cognitions, positive psychology model refers to the possible primary role of some emotional factors.

In this paper we empirically examine how household income relates to emotions, cognitions, and satisfaction with life. Various studies, including “World Value Survey”, indicate that for decades Lithuania has been among the countries demonstrating the lowest scores on happiness and the highest rates of suicides in Europe. However, according to the GDP data, Lithuania is not among the poorest countries of the world. On the contrary, Lithuanian governments have claimed that the States’ economic situation has been progressing considerably since Lithuania regained its’ independence in 1991. As Lithuanians still are not happier, and some of them (especially, low income groups) even create a lot of problems in society and other countries, this sample is particularly interesting and relevant to explore. Therefore, we aimed at evaluating the cognitive - emotional processes underlying “happiness - income relation”: association between emotions, cognitions, satisfaction with life, and household net income.

We make the following new contributions. Firstly, we find that when people get low household income per month, they report more intense negative emotions, and demonstrate less positive emotional states. Secondly, our results suggest that people getting low household income per month express more negative cognitions and report less positive cognitions. Thirdly, the results demonstrated strong relationship between positive cognitions, positive emotions, and satisfaction with life. Our results contribute to the empirical literature on “income – happiness” relationship by demonstrating that household income has no significant direct effect on satisfaction with life, but there is a significant effect of household income on cognitions and emotions which, subsequently, have an effect on satisfaction with life.

2.1. Survey and sample characteristics

This study used a test design utilizing a heterogeneous random sample of 1001 person representing Lithuanian population. All the participants were personally asked to participate in the study. Lithuanian respondents were personally interviewed at their home, the interview took approximately 1,5 hours. Lithuanian sample was selected in a multi-scaled probabilistic way so that every citizen of Lithuania might have an equal probability to be interviewed. The survey was performed in 2016. K- means analysis was applied to cluster the respondents into low, medium and high household net income groups.

2.2. Measures

The measures used in this study included:

The Satisfaction with Life Scale or SWLS was used to assess psychological wellbeing. This measure was developed by Ed Diener (Diener, Emmons, et al., 1985), and it involves five questions, rated on a Likert-type scale including response options ranging from “totally disagree” to “totally agree”. The SWLS has been validated in many contexts (Diener, 2004). The Satisfaction with Life Scale demonstrated acceptable reliability in this study: SWLS Cronbach’s alpha for Lithuanian sample was = .89.

Emotional states scale. To assess specific states of Lithuanian population, we have created a modified version of the Positive and Negative Affect Scale, created by Watson, 1994 and SPANE, created by Ed Diener and Robert Biswas-Diener, 2009. All responses were anchored on a 6-point Likert scale, ranging from “never” to “always”. Cronbach’s alpha for this sample was = .82.

Basic cognitions scale. To assess Lithuanians’ attitudes towards life, we have created a questionnaire based on the works of positive psychology scholars (e.g., Diener & Seligman, 2004; Warburton, 1996; Veenhoven, 2003; Ryan & Deci, 2000; Tov & Diener, 2009; Sirgy & Wu, 2009; Sirgy, 2012; Seligman, 2011; Ryff & Singer, 1996; Parducci, 1995; Hayborn, 2008; Diener, Wirtz, Tov, Kim-Prieto, Choi, Oishi & Biswas-Diener, 2010). It involves questions, rated on a Likert-type scale including 6 – point response options ranging from “totally disagree” to “totally agree”. The self-reported measure of basic cognitions is constructed from the following questionnaires: Flourishing scale,

Ed Diener and Robert Biswas-Diener, 2009; Hadley Cantril's Self-Anchoring Striving Scale, 1965; PSYCAP, F. Luthans, 2007. All the listed questionnaires, presented in this study, demonstrated acceptable reliability: Cronbach's alpha for this sample varied from .80 to .92 (n=1001).

Survey was held in: Vilnius, Kaunas, Klaipėda, Šiauliai, Panevėžys, Alytus District, Šakiai District, Utena District, Tauragė District, Švenčionys District, Raseiniai District, Kupiškis District, Molėtai District, Akmenė District, Rokiškis District, Telšiai District, Mažeikiai District, Marijampolė District, Trakai District, Varėna District, Kretinga District and Ukmergė District. The research was conducted in 19 cities and 24 villages.

3. Results

3.1. Effect of household income on self-reported emotional states

A one-way between subjects ANOVA was conducted to compare the effect of household income per month on emotional states during the last week in clustered low, average, and high household income conditions.

There was a significant effect of household income per month on negative emotional states at the $p < .05$ level for the following emotions: anger $F(2, 906) = 3.10$, $p = .045$, $\eta^2 = .007$, despair $F(2, 903) = 8.26$, $p = .000$, $\eta^2 = .018$, fear $F(2, 902) = 5.51$, $p = .004$, $\eta^2 = .012$, sadness $F(2, 904) = 5.06$, $p = .007$, $\eta^2 = .011$.

However, there was not a significant effect of household income per month on emotional states at the $p < .05$ level for the following emotions: anxiety $F(2, 906) = 1.56$, $p = .210$, shame $F(2, 895) = 0.10$, $p = .904$, guilt $F(2, 903) = 2.63$, $p = .528$.

Posthoc analyses using Tukey's HSD indicated that the mean anger score was significantly higher for medium household income group to compare with low income group ($p = .036$), but significantly lower to compare with highest income group which demonstrated the highest anger scores ($p = .041$).

Sadness was significantly higher for low household income group to compare with medium income group ($p = .004$), but the highest income group did not differ significantly between participants with low or medium income.

Interestingly, there was a significant effect of household income per month on positive emotional states at the $p < .05$ level for the following emotions: peace $F(2, 897) = 6.64$, $p = .001$, $\eta^2 = .015$, happiness $F(2, 896) = 8.39$, $p = .000$, $\eta^2 = .018$, optimism $F(2, 897) = 8.87$, $p = .000$, $\eta^2 = .019$, hopefulness $F(2, 896) = 8.29$, $p = .000$, $\eta^2 = .018$, joy $F(2, 897) = 6.23$, $p = .002$, $\eta^2 = .013$.

Post hoc comparisons using the Tukey HSD test indicated that the mean score of above listed positive emotions was significantly different for the low, medium and high household income groups: the mean peace score was significantly higher for the high household income group to compare with low income group ($p = .004$) or medium household income group ($p = .039$).

Happiness mean score was significantly lower for low household income group to compare with medium household income group ($p = .002$) or high household income group ($p = .033$). However, the medium and high household income groups did not differ significantly.

Optimism was significantly lower ($p = .001$) for the low income group to compare with medium income group, but the high income group did not differ significantly between participants with low and medium income. Compassion

was significantly higher for the high household income group to compare with low income group ($p=.031$), but it did not differ significantly to compare with medium income group.

Hopefulness was significantly higher for medium household income group to compare with low income group ($p=.001$), but the high income group did not differ significantly between participants with low and medium income.

The mean score of joy was significantly lower for low income group ($p=.012$), but the high household income group did not differ significantly between participants with low and medium income.

Taken together, these results suggest that household income per month really do have an effect on emotional states. Specifically, our results suggest that when people get low household income per month, they report more intense negative emotions, and demonstrate less positive emotional states. However, it should be noted that household income differences level must be high in order to see an effect. High household income appears to significantly increase positive emotions and diminish negative emotions to compare with low household income group, and medium household income appears to significantly increase positive emotions and diminish negative emotions to compare with low household income group, but mostly high household income does not appear to significantly increase positive emotions and diminish negative emotions in compare to medium household income group.

3.2. Effect of household income on cognitions

A one-way between subjects ANOVA was conducted to compare the effect of household income per month on cognitions (perceptions of self and life) in low, average, and high household income conditions.

There was a significant effect of household income per month on perceptions of self and life at the $p<.05$ level for the following positive cognitions: “I have clear life goals” $F(2, 903) = 21.50, p = .000, \eta^2 = .045$, “I think I am a happy person” $F(2, 905) = 19.89, p = .000, \eta^2 = .042$, “There are a lot of people with whom ever I can openly talk about my concerns” $F(2, 904) = 3.21, p = .041, \eta^2 = .007$, “I am satisfied with my life” $F(2, 909) = 26.30, p = .000, \eta^2 = .055$, “My life is valuable” $F(2, 908) = 19.98, p = .000, \eta^2 = .042$, “I trust in myself, that I will successfully overcome the difficulties / challenges of life” $F(2, 909) = 15.40, p = .000, \eta^2 = .032$.

Posthoc analyses using Tukey’s HSD indicated that in low income group were significantly weaker expressed all positive cognitions. Significantly weaker was expressed cognition “I have clear life goals” to compare with medium ($p=.000$) and high ($p=.001$) household income groups, cognition “I think I am a happy person”, to compare with medium ($p=.000$) and high ($p=.001$) household income groups, cognition “There are a lot of people with whom ever I can openly talk about my concerns” to compare with medium ($p=.000$) and high ($p=.001$) household income groups, cognition “I am satisfied with my life” to compare with medium ($p=.000$) and high ($p=.001$) household income groups, cognition “My life is valuable” to compare with medium ($p=.000$) and high ($p=.001$) household income groups, cognition “I trust in myself, that I will successfully overcome the difficulties / challenges of life” to compare with medium ($p=.000$) and high ($p=.001$) household income groups.

Taken together, these results suggest that household net income per month really do have an effect on cognitions. Specifically, our results suggest that people getting low household income per month, express more negative cognitions and less positive cognitions.

3.3. Satisfaction with life in high, medium and low household income groups in positive and negative emotional clusters

A 2 X 2 factorial analysis of variance tested the effects of the household income and emotions on respondent’s satisfaction with life. Results has indicated a significant main effect for the emotions factor, $F(1, 886) = 27.01, p =$

.000, $\eta^2 = .03$. As hypothesized, those who reported more positive emotions showed higher satisfaction with life ($M = 3.71$, $SD = .88$) compared to those who reported more negative emotions ($M = 2.87$, $SD = .96$).

Results has also indicated a significant main effect for the income factor, $F(2, 886) = 6.09$, $p = .002$, $\eta^2 = .014$. People in the low income group were the least satisfied with life ($M = 3.40$, $SD = .98$) compared to medium income group ($M = 3.76$, $SD = .90$) or high income group ($M = 4.12$, $SD = .85$). Posthoc analysis using Bonferroni indicated that mean difference in satisfaction with life was significant for low and medium income group ($p < .001$), as well as low and high income group ($p = .001$), however, as demonstrated in Table 1, the mean difference was not significant for medium and high income groups ($p = .270$).

Table 1.

Satisfaction with Life Means for Different Household Income and Emotions Groups.

Household income groups, per month	Emotions clusters	M	SE	95% CI	
Low	Negative emotions	2.82	.063	[2.70,	2.94]
	Positive emotions	3.62	.040	[3.54,	3.70]
Medium	Negative emotions	3.16	.146	[2.88,	3.45]
	Positive emotions	3.91	.073	[3.76,	4.05]
High	Negative emotions	2.30	.629	[1.06,	3.53]
	Positive emotions	4.32	.210	[3.91,	4.73]

Note. M=mean, SE = Standard Error, CI = confidence interval.

A 2 X 2 factorial analysis of variance tested the effects of the household income and cognitions on respondent's satisfaction with life. Results has indicated a significant main effect for the cognitions factor, $F(1, 870) = 18.74$, $p = .000$, $\eta^2 = .021$. As demonstrated in Table 2, those who reported more positive cognitions, showed higher satisfaction with life ($M = 4.11$, $SD = .77$) compared to those who reported more negative cognitions ($M = 3.07$, $SD = .92$).

Table 2.

Satisfaction with Life Means for Different Household Income and Cognitions Groups.

Household income groups, per month	Cognitions clusters	M	SE	95% CI	
Low	Negative cognitions	3.05	.041	[2.97,	3.13]
	Positive cognitions	4.07	.058	[3.96,	4.18]
Medium	Negative cognitions	3.13	.103	[2.92,	3.33]
	Positive cognitions	4.19	.082	[4.03,	4.35]
High	Negative cognitions	3.80	.502	[2.81,	4.78]
	Positive cognitions	4.17	.217	[3.75,	4.60]

Note. M=mean, SE = Standard Error, CI = confidence interval.

Furthermore, bivariate correlation of positive cognitions, positive emotions and satisfaction with life revealed strong significant ($p < .001$) positive relationships between the factors, as demonstrated in Table 3.

Table 3.

Bivariate Correlations of Positive Cognitions, Positive Emotions, and Satisfaction with Life.

	<i>M</i>	<i>SD</i>	Positive cognitions	Positive emotions
1. Positive cognitions	4.05	(.79)	1	
2. Positive emotions	3.82	(1.32)	.530**	1
3. Satisfaction with life	3.52	(1.05)	.657**	.500**

** . Correlation is significant at the 0.01 level (2-tailed).

Structural equation modeling (SEM) using software package AMOS has been applied to investigate theory-derived structural hypotheses. The results are demonstrated in Table 4 and Figure 1.

Table 4.

Unstandardized, Standardized, and Significance Levels for Model in Figure 1 (Standard Errors in Parentheses)

<i>Parameter Estimate</i>	<i>Unstandardized</i>	<i>Standardized</i>	<i>p</i>
Total household net income → Cognitions	.00 (.00)	.26	.00
Cognitions → Emotions	.90 (.05)	.55	.00
Emotions → Satisfaction with life	.15 (.02)	.19	.00
Cognitions → Satisfaction with life	.74 (.04)	.56	.00
Total household net income → Satisfaction with Life	.00 (.00)	.03	.25

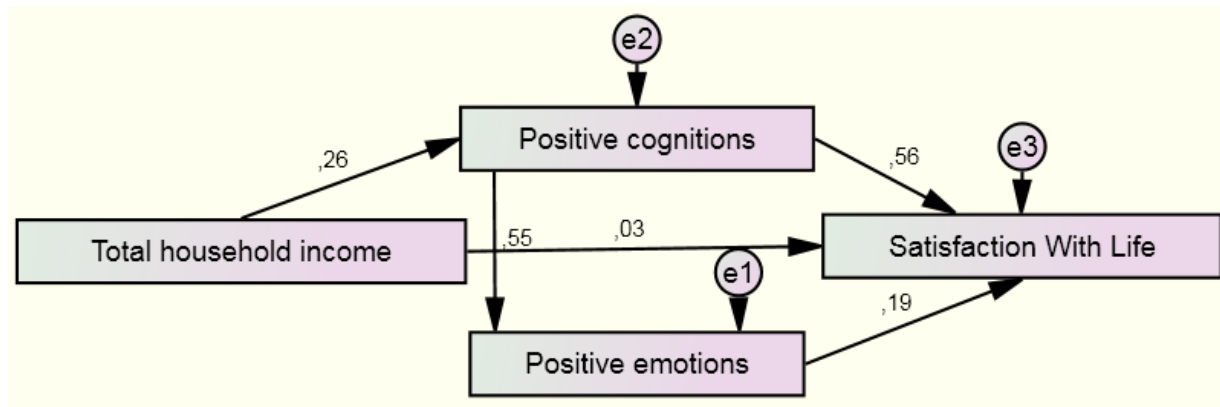


Figure 1.

Structural Equation Model of Interactions between Total Household Net Income, Positive Cognitions, Positive Emotions, and Satisfaction with Life (Standardized Solution).

Taken together, the results mean that household net income has no significant direct effect on satisfaction with life ($\beta = .029$; $p = .246$), $R^2 = .454$, $\chi^2 (1, n = 916) = 0.16$, $p = .690$, $RMSEA = .000$; $CMIN/DF = .159$, $RFI = .998$. However, there is a significant effect of household net income on cognitions ($\beta = .262$; $p < 0.001$), and, subsequently, there is a significant strong effect of cognitions on emotions ($\beta = .548$; $p < 0.001$). Moreover, there is a significant effect of cognitions ($\beta = .564$; $p < 0.001$) and emotions ($\beta = .189$; $p < 0.001$) on satisfaction with life.

Conclusions

The presented study aimed at evaluating the effect of household income on cognitions, emotions and satisfaction with life in Lithuanian representative sample. There was found a significant effect of household income per month on several negative emotional states.

Interestingly, there was a significant effect of household income per month on positive emotional states for the following emotions: peace, happiness, optimism, hopefulness, joy. Taken together, these results suggest that household income per month really do have an effect on emotional states during the last week. Specifically, our results suggest that when people get low household income per month, they report more intense negative emotions, and demonstrate less positive emotional states.

However, it should be noted that household income differences level must be high in order to see an effect. High household income appears to significantly increase positive emotions and diminish negative emotions to compare with low household income group, and medium household income appears to significantly increase positive emotions and diminish negative emotions to compare with low household income group, but mostly high household income does not appear to significantly increase positive emotions and diminish negative emotions in compare to medium household income group.

The results have also demonstrated a significant effect of household income per month on perceptions of self and life for the negative cognitions. These cognitions were more expressed in low household income group. Moreover, there was a significant effect of household income per month on perceptions of self and life for some positive cognitions. These results suggest that household income per month really do have an effect on cognitions. Specifically, our results suggest that when people get low household income per month, they express more negative cognitions and less positive cognitions.

The analysis of effects of the household income and emotions on respondent's satisfaction with life has indicated a significant main effect for the emotions factor. Those who reported more positive emotions showed higher satisfaction with life compared to those who reported more negative emotions. Results have also indicated a significant main effect for the income factor. The mean difference in satisfaction with life was significant for low and medium income group, as well as low and high income group, however, the mean difference was not significant for medium and high income groups.

The analysis of effects of the household income and cognitions on respondent's satisfaction with life has indicated a significant main effect for the cognitions factor: those who reported more positive cognitions, showed higher satisfaction with life compared to those who reported more negative cognitions.

Bivariate correlation revealed strong significant positive relationships between positive cognitions, positive emotions and satisfaction with life.

Our results contribute to the empirical literature on "income – happiness" relationship (Easterlin, 2001; Diener, 2004; Graham, 2010). The results support model of R. A. Easterlin on the importance of cognitions in "money-happiness" association. Moreover, it supports works of E. Diener on the higher impact of money on happiness in poorer societies.

Structural equation modeling (SEM) demonstrated that household net income has no significant direct effect on satisfaction with life, but there is a significant effect of household income on cognitions, and a significant effect of cognitions on emotions. Subsequently, cognitions and emotions have an effect on satisfaction with life. Therefore, our results contribute to the theoretical discussion on household income and satisfaction with life role in A (activating factor) - B (beliefs) - C (consequences) model. Low household income activates Lithuanian's negative

cognitions, life and self- perceptions, which might give rise to negative emotional states, inability to feel peacefulness, happiness, and these factors altogether lower Lithuanians' satisfaction with life.

Nevertheless, the present study still cannot explain “cognitive - emotional impact paradox”. The results affirm the role of cognitive factors; however, some authors (e.g., Diener, 2010) would argue that satisfaction with life itself is a cognitive component of subjective wellbeing. The core of “cognitive - emotional impact paradox” is that cognitive factors (expectations, social comparisons, life evaluations, schemas) is the mediating part between income and happiness, however, positive psychology suggests that happiness determines the effect of social comparison itself. Cognitive therapy model would point out to the primary role of cognitions in “money-happiness” relationship, but positive psychology refers to the possible primary role of emotional factors, and this paradox needs further exploration.

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Aknowledgements

This work was supported by the Research Council of Lithuania [grant number GER-009/2015].

Aiste DIRŽYTĖ - researcher, clinical psychologist, Head of Psychological Well Being Research Laboratory at MRU, Professor at Institute of Psychology, MRU and Assoc. Prof. at Business School at Vilnius University (since 2013). She holds a PhD in psychology (since 2001). She is also a founder of the Institute of Management and Psychology (2008), Life Quality Improvement Center (2002), and participates in Melkys' ecocommunity (since 2012). Aiste Dirzyte is a member of American Psychological Association and International Positive Psychology Association. **Research interests:** NVC (non violent communication), PsyCap (psychological capital: self efficacy, hope, resilience, optimism), POB (positive organizational behavior), positive leadership, self management (self regulation, self acceptance, self compassion).

Ona Gražina RAKAUSKIENĖ – Dr. Habil. of Social Sciences (Economics), Professor of Mykolas Romeris University, Head of the Quality of Life Laboratory. **Research interests:** quality of life, sustainable wellbeing, gender economics, social and economic cohesion policy of EU. Ona Gražina Rakauskienė – is a researcher, an expert and leader of researches and projects. During her scientific career, she has built up significant experience in research projects' management at the national and international levels. She has prepared abosues ut 300 scientific publications, 10 monographs, participated in more than 50 projects and scientific applied researches as a research leader. She was an Expert of the International Consulting Group OXFORD XXI (Great Britain, London) according to the programme EC FP7 ENRI – East (2011-2013), member of the organisational committee of the International Network “Nord-Baltic Gender Responsive Budget” (2007-2011), Editor-in-Chief and Chairwoman of editorial board of scientific research journal of Mykolas Romeris University “Intellectual Economics” (2011- 2015), now she is member of editorial boards of scientific research journals of Mykolas Romeris University “Intellectual Economics” (Lithuania), of University „Torun School of Banking“ „, Torun Business Review“, of international scientific research journal „Journal of Security and Sustainability Issues” (SCOPUS), Elsevier; of international scientific research journal „Entrepreneurship and Sustainability Issues” (Thomson Reuters, Scopus). 2014-2016 Member of editorial board of international scientific research journal „Entrepreneurship and Sustainability Issues”, ISSN 2345-0282 online, SCOPUS, Thomson Reuters, <http://jssidoi.org/jesi/aims>

Vaida SERVETKIENĖ is a lecturer of Mykolas Romeris University, Advisor of the Office of the Secretary General of the Seimas (Parliament) of the Republic of Lithuania. She has an experience both in the field of scientific research and in the field of public administration. Therefore in the Project's implementation there will be useful to connect the results of scientific research with their practical application. In 2013 V. Servetkienė defended doctoral dissertation “Multidimensional Assessment of the Quality of Life Identifying Critical Areas” (Social Sciences, Economics). Scientific research interests: quality of life of population, material welfare, socio-economic inequality, social exclusion and vulnerable society groups. V. Servetkienė has published 13 scientific publications, together with co-authors has published 4 monographs, and 1 scientific study. ORCHID ID:

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ISSN 2345-0282 (online) <http://jssidoi.org/jesi/aims-and-scope-of-research/>

SUSTAINABILITY OF COMMUNITY'S ENTREPRENEURSHIP: CASE OF FLOATING MARKET AT LADMAYOM

Supawadee Boonyachut

King Mongkut's University of Technology Thonburi, Thailand

E-mail: supawadee.boo@kmutt.ac.th

Received 20 August 2016; accepted 10 October 2016

Abstract. Ladmayom Market was created in 2003 by a community leader as an effort of sustaining the existing orchard to gain additional income among the villagers, and to maintain the existing life styles. Over a decade, the flea market was expanded around the original community floating market. Ladmayom Market, a one-man originated project, is currently a large market belonging to various land owners. The expansion of the market is sprawled according to the plot of lands. Because of this condition, the sustainability of the market declines as a whole due to its mixed up circulation, unpleasant patches of abandoned selling stalls, unequal business opportunity for merchants in some zones and lack of precise directions so that the customers easily lose their ways. Hence, this research regarded as a guide recommends a short term plan to sustain the community floating market by creating a better wayfinding. Its final result from all stakeholders who participated in public meeting and field survey is composed of directory, directional signs and other necessary categories for the market.

Keywords: floating market, stakeholders participation, community, entrepreneurship, short term plan, wayfinding, sustainability

Reference to this paper should be made as follows: Boonyachut, S. 2016. Sustainability of community's entrepreneurship: case of floating market at Ladmayom, *Entrepreneurship and Sustainability Issues* 4(2): 211-219.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(8\)](http://dx.doi.org/10.9770/jesi.2016.4.2(8))

JEL Classifications: M20; M21

1. Introduction

Indicated in the interview with an expert in market business in Thailand, which was conducted on February AD 2011, a flea market became popular in the past five years predominantly during the period of unemployment and rising cost of gasoline. These two main reasons pushed the consumers to buy household and dairy items from the places close to their houses to save transportation expenses (Wattanawanyoo et al. 2012). Straight from work, they

came and bought what they needed in their households such as daily food. There were meat, daily consumed food, preserved food, ready-to-serve food, desserts, costumes and low-cost household items which were not sold in the morning fresh market. Purchasing from flea markets, the consumers could also reduce their expenses due to cheaper costs of costumes, household appliances, costume jewelry, and decorative products.

The flea market in Thailand is typically “an economic flea market” which is established along the side walk, in the open empty land, in the temple’s plaza, or the office’s plaza for the convenience of communities. Some flea markets are also located in the parking area of existing fresh markets or morning markets and supervised by professional management companies for commercial purposes. The establishment of flea market in a fresh market property would encourage as well as keep customers to come in both markets. Besides, the low-priced merchandises attract people from neighboring places to shop in flea markets during rotational days of selling. Subsequently, this provides more success to fresh markets becoming a part of each other (Boonyachut et al. 2011).

On the other hand, there are flea markets operating as “tourist flea markets”. They have been established in agricultural areas by the community leaders so as to develop their community surroundings, and to encourage the villagers to gain additional profit from selling fruits, and vegetables grown in their lands. Ladmayom Market is one of these types, “tourist flea markets” (Boonyachut et al. 2011). In terms of an average merchant's income, it has more success than the economic flea market (Boonyachut et al. 2011).

2. Literature Review

Ladmayom Market, which is an orchard community, is located in Bangkok. The name of the canal, Ladmayom, has become a “geographical identification” of this market. It is a medium-sized market (Boonyachut et al. 2011) of about nine acres located on Bang Ramat Road in the Taling Chan district on the west side of Bangkok. The drive from Victory Monument, which is considered a city center, is 18 kilometers and takes approximately 33 minutes in normal traffic condition.

From the previous study on “Community market fair: Efficient management and local creative economy”, which used Ladmayom Market as one of the case studies, the researchers found that Ladmayom Market became known to the public as the community leader’s objective to encourage outsiders in promoting environmental preservation project on the basis of the villagers’ campaign and goal for a clean canal. The community leader started the project by collecting garbage along Ladmayom canal. Then, he persuaded the villagers to sell their orchard products such as fruits, vegetables, and flowers so as to gain additional income, and join the creative activities around their community on weekends. When the community was alerted towards further pace, he conjoined the Ladmayom community market with the local administration tourism network, the Talingchan floating market network. The market is idealized as a “floating market of merit without cigarettes, liquor and beer being sold”, and it operates at an average of 2 days a week on the weekends and any public holidays. The orchard goods and provisions on floating boats are sold along the Ladmayom canal whereas the luxury items are sold on land along both sides of the canal and on both sides of road that cuts through the community. Besides, the villagers can gain a higher average income than the merchants in other economic flea markets, which open at an average of more than 3 days a week. Thus, this indicates that the tourist flea market has more success than the economic flea market (Boonyachut et al. 2011). The success of Ladmayom Market leads to its rapid expansion. Nowadays, the market expands to seven zones owned by seven land owners connecting their areas to the original market place.

Most of the Ladmayom Market’s merchants live around the community. They travel not more than 10 kilometers distance to sell their goods at Ladmayom Market as their sideline job. The merchants are the lower middle class group classified according to their income and working age range, 21-50 years old. A little over one-tenth of the merchants are high school educated individuals while the rest are educated higher. Three quarters of the customers coming to the market are casual customers, and a quarter of those are regular customers. Most of the customers

come from afar; they travel 10 to 20 kilometers to the market. Some travel farther than 20 kilometers up to 70 kilometers. They are also the lower middle class group that is categorized by their income. Less than one-tenth of the customers are high school educated individuals while the rest are educated higher. The customers of all ages include working people, family groups, elderly, children, teenagers and students. Customers get pleasure from the activities such as horse riding, rowing boat to view the orchard and the temple along the canal, walking tour to see the old houses in the orchard scenery, teaching English to interested people, listening to a discourse on the day of the match, feeding a buffalo, and reading book in the informal library.

The rapid expansion of Ladmayom Market into many zones is detracted from the good intent of the original market aim. Likewise, the market development is geared in the direction of gaining quick benefits after the severe flooding which occurred during the 2011 monsoon season in Thailand. On this condition, the sustainability of the market declines as a whole caused by mixed-up circulation, unpleasant patches of abandoned selling stalls and unequal business opportunity for merchants in some zones (Boonyachut et al. 2012). The previous research, “Community market fair: Efficient management and local creative economy”, adapted stakeholder participation from The Weave - Participatory Process Design Guide for Strategic Sustainable Development)v1((Meisterheim et al. 2011) and “The New Guide to Identity” (Olin 2011). The conclusion derived from stakeholders, community leader, land owners, merchants, and customers was to move the market in the direction of “Maintaining the present lifestyle and orchard community, and earning additional income on the weekends” (Boonyachut 2016). Thus, Ladmayom Market should be a good prototype for those communities aiming to develop strong and responsive organizations. However, the sprawling market expansion needs both short term and long term plans to sustain the coexistence of commercial and orchard lifestyles in Ladmayom Floating Market as concluded in previous research. The previous research recommended a long term plan (Boonyachut 2016) in which its achievement requires the negotiation and compromise among landowners, and the acquisition of necessary funds and permits from the local administration. Therefore, this research is set to propose the short term plan to sustain the community floating market in Ladmayom while the long term plan is initiated.

3. Methodologies

The following methods were used in the research:

- Literature review from previous research to understand all groups of stakeholders and the factors which have brought them to Ladmayom Market, and the market direction;

- Observation;

- Identifying problems and analysis;

- Finding result to solve problems. The research utilizes two methods to serve different purposes (Meisterheim et al. 2011) and to ensure the involvement of all stakeholder groups (Kemmis, McTaggart 2005).

 - The public meeting participated by available stakeholders

 - The field survey

It is a recognized fact that stakeholder participation is necessary to make the community sustain (Taştan, Ciravoğlu 2016). The sample group for field survey is determined (Krejcie, Morgan 1970) and the data are analyzed using SPSS software. The statistics used for data analysis includes frequency, percentage, mean, standard deviation, and Pearson correlation coefficient; and

Conclusion.

4. Finding Problems and Analysis

The researchers observe that there are problems in the market layout. The sprawling expansion causes mixed up circulation, misleading directions, and difficulty in communicating the meeting area in case a group of people go in separate ways. Since the market has been expanded without a plan, the main element to consider is to design many types of signage to direct the way easily. To address the problems, the market's layout is analyzed to derive necessary type and location of signage. There are many entry accesses to the market; hence, directories and signs

showing directions of each zone are needed. Before designing signage, the zone or area identification should be done by naming all zones precisely. Thus, the appropriate method to name the zone is analyzed in three schemes:

- The numbering scheme of the current zones in Ladmayom is shown in Figure 1a. The sequential number can be provided in the current zones; however, the future zonal expansion might not follow the current sequence, and the name scheme will then create confusion similar to the example shown in Figure 1b.

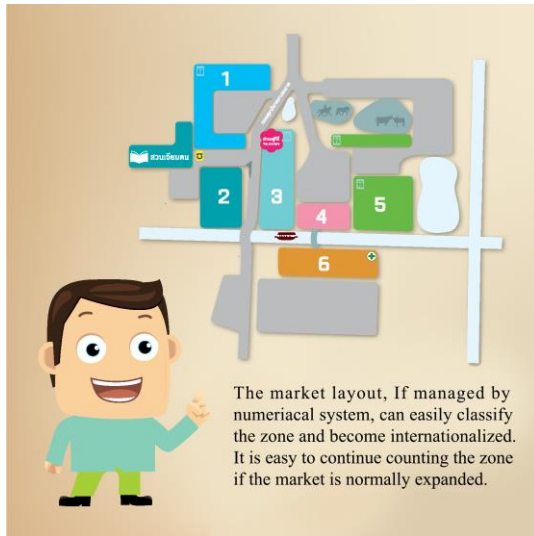


Figure 1a. Naming the zones by number in a regular expansion case

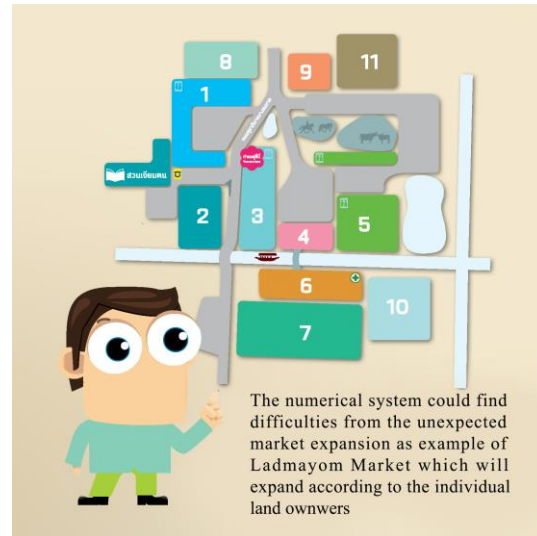


Figure 1b. Naming the zones by number in sprawling expansion case

- Naming the zone after the name of the land owner does not show the market identity (Cross 19)
- Naming the zone as part of brand identity for Ladmayom Market

5. Finding Result

To come up with a collaborative idea to design zone identification or naming zone as part of brand identity for Ladmayom Market (Olin 2011, Boonyachut et al. 2013), the researchers have a critical analysis and serious discussion with community leader and land owners. Their preference is that the name of the zone begins with “Mayom”, which means star gooseberry in English, because it is related to the name of the market “Lad+Mayom”. The second word in the zone name will identify the character of location, merchant, and other categories associated to the market such as “shady”, “joyfully”, and “smiley”. The researchers designed the icons to represent the zone name in three schemes as shown in Figure 2. The scheme that was selected by stakeholders is the one on the left column of Figure 2. The selected icons have clear representation of the star gooseberry with not much content and easiest of all to understand.



Figure 2. Designed by researchers, the icons representing the zone name with images related to star gooseberry fruit, Mayom, as a brand identity for Ladmayom Market are provided for stakeholders to select

Consequently, all elements such as icon, lettering, and color are put together under the concept of little content. The color of each zone will be different, so it's easy to remember and to read labels. The color is controlled in a comfortable tone to fit the theme of weekend market, explicitly, not too flashy look which will not fit to local market. The public meeting to hear comments pertaining to all elements in the sign involves the community leader, land owners, and merchants, only in a total of 20 persons. The public meeting receives satisfaction result for the overall aspect of the sign.

Due to lack of available time, the customers are not involved in the public meeting. Therefore, the field survey consisting of a number of questions based on the resolutions made during the public meeting is conducted. The signage tested in the field survey is composed of 3 directories and 10 directional signs installed in the locations as shown on the map in Figure 3. In the field survey, there are 255 respondents)from a group of costumers(. It also includes 55 merchants because most of them who are involved in the public meeting are also Ladmayom villagers. Thus, those merchants coming from other neighboring areas are also part of the stakeholder participation process. With 0.961 reliability level, the overall feature of the sign has gained acceptable satisfaction from three quarter of respondents.

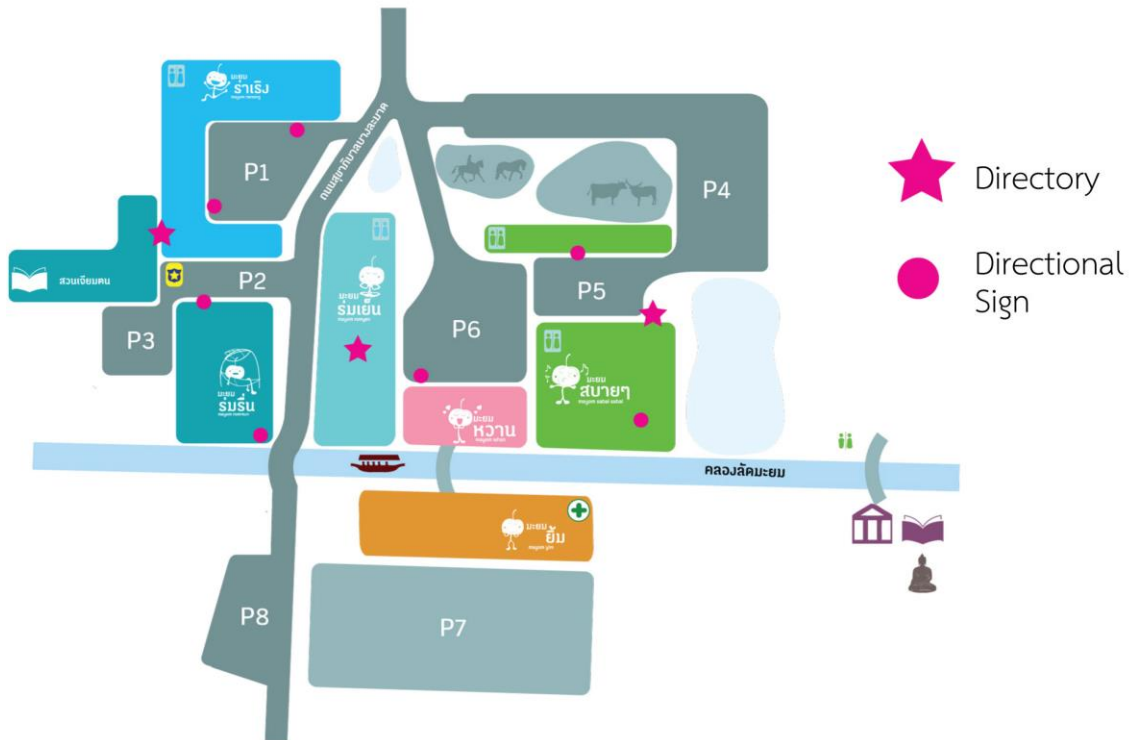


Figure 3. Location of the testing signs

On the other hand, there are several suggestions from respondents to adjust the size of the sign a little bigger and adding more signs in many other locations to avoid confusions and to designate zones accurately.

6. Conclusions

The final decision on zone name and signage design are concluded as shown in Figure 4a and the color of each zone will be different and suitable to the zone name. All colors are in a comfortable tone to fit the theme of weekend market and existing market logo (Boonyachut et al. 2013) designed in previous research by the same researcher team as shown on top of Figure 4b.



Figure 4a. Final scheme of zone name and color

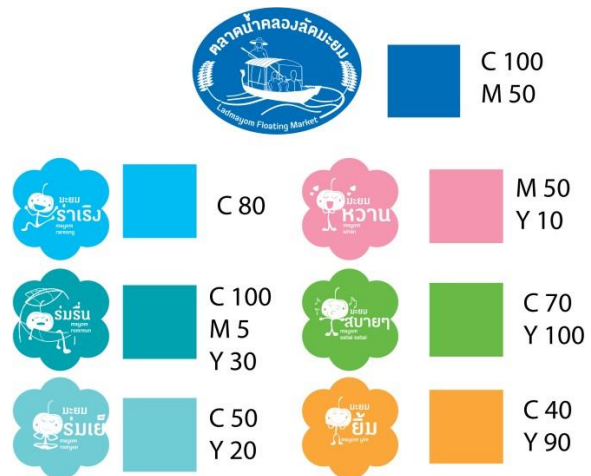


Figure 4b. Final color scheme of each zone

The final design of directory and directional sign for the market as suggested by respondents are shown in Figure 5. Customers suggest more locations of wayfinding to ensure that they are not lost, and that they are able to reach their destinations. Other recommendations to be implemented as a short term plan of the market community include the following:

- Adding parking signs in the zones that are close to the parking area, as shown in Figure 6
- Adding directories in the front of toilets and all parking areas, as shown in Figure 6
- Having directory leaflets as free postcard and mini map
- Installing zone name sign in all selling stalls
- Pinning the zone name on each merchant's shirt

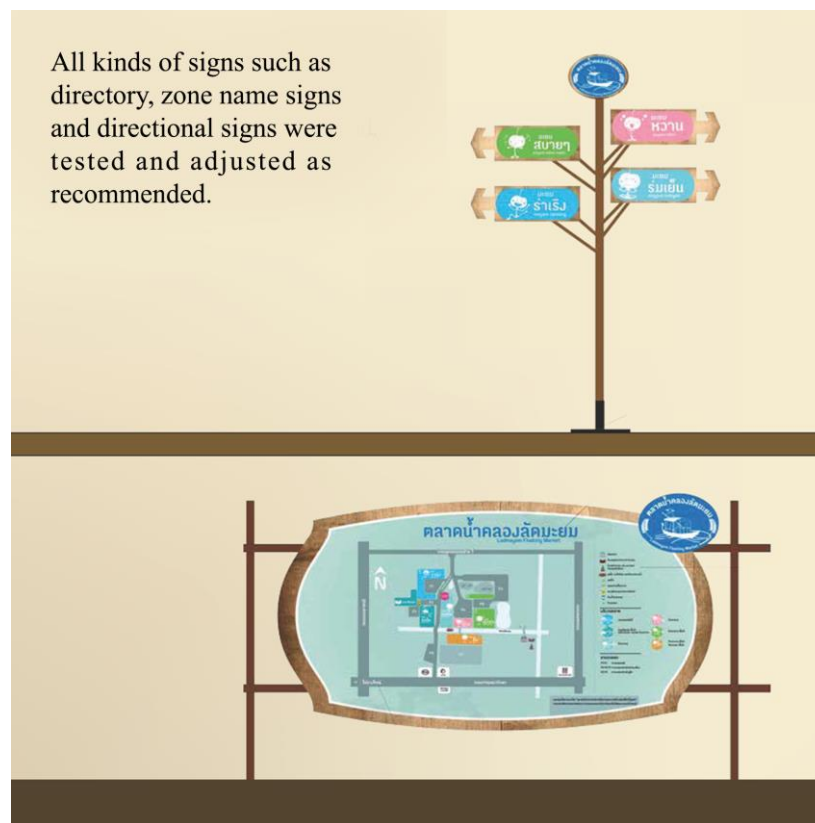


Figure 5. Final Directional Sign and Directory



Figure 6. Directory and direction to parking sign in the locations recommended by the customers

7. Suggestions

The strong points of Ladmayom Market can emerge if the following conditions are considered:

- The good environment, i.e. The clean canal must attract customers to come in as usual.
- Good taste of food and good price make customers feel easy to pay.
- The efficient management within the market would make customers feel comfortable and willing to come again.

All of the aforementioned items and the short term plan in addition to this research result and long term plan of the previous research result can make the business successful and sustain the coexistence of commercial and orchard lifestyles in Ladmayom Floating Market. However, the knowledge transfer from academic to community's entrepreneurship is difficult (Ignatavičius et al. 2015) due to loose bonding between land owners as a cluster (Tvaronavičienė, Černevičiūtė 2015; Razminienė et al. 2016).

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Supawadee BOONYACHUT - a fulltime instructor, Assistant Professor at the School of Architecture and Design, King Mongkut's University of Technology Thonburi, Thailand, completed Bachelor Degree in Architecture, graduated from the University of California, Los Angeles with a Master of Architecture, major in Design Theory and Methods. In addition to teaching the theory on Materials and Construction Technology, she is also a thesis advisor in Architecture program. Working in education field allows her to work effectively as a professional architect, teacher, writer, and researcher in different aspects and cross-disciplinary fields such as engineering, communication design, and social science. Her latest researches involved participatory process with stakeholders in the research communities. She wrote three books related to her researches in Thai. Two books are about materials and construction: the first one focuses on bilingual technical terms and the second is related to her previous cross-disciplinary research in engineering. The third book is a cross-disciplinary with communication design field.



ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

TRANSPARENT LOBBYING FOR SUSTAINABILITY: CASE OF LITHUANIA

Andrius Stankevičius*, Asta Lukšaitė **

**Mykolas Romeris University, Faculty of Public Security, Department of Law
V. Putvinskio str. 70, LT-44211, Kaunas*

***JSC "Mitris Group" consultant
Didžioji str. 30, LT-45460, Kaunas*

*E-mails: * stankevicius@mruni.eu; ** nfo@mitrisgroup.com*

Received 15 May 2016; accepted 29 August 2016

Abstract. The aim of presented paper is to provide interpretation possibilities of transparent, integral lobbying phenomenon in Lithuanian law system and to divulge possible points of interaction between lobbying and sustainable development. Authors reveals definitions of lobbying, according to legal regulation of lobbying in EU and Lithuania legal acts. With reference to expert interview results and analysis, were identified problematic aspects, which helped to formulate the interim and final conclusions. Also authors seeks to find answer the question if science sector⁷ is active in latent⁸ lobbying; what patterns and possible trends of this phenomenon with sustainable development. Science, as social technology, is the driving force of the sustainable development and industrial revolution. Its mentioned in EU and Lithuanian long term strategic documents. This affects to research manifestations of lobbying in this sector. Obtained results, it is believed, will help to improve lobbying law regulation; will create preconditions to remove the legal contradictions and loopholes; will shape favorable environment for sustainable development and competitiveness process.

Keyword: lobbying, lobbyist, science, legislation, decision maker, interest groups, transparency and integrity in lobbying.

Reference to this paper should be made as follows: Stankevičius, A.; Lukšaitė, A. 2016. Transparent lobbying for sustainability: case of Lithuania, *Entrepreneurship and Sustainability Issues* 4(2): 220-227.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(9\)](http://dx.doi.org/10.9770/jesi.2016.4.2(9))

JEL Classifications: H30

⁷ Science means higher education and research sector.

⁸ Definition "latent lobbying" reveal also such meanings of negative lobbying as "illegal lobbying", "closed door lobbying", "not ethical lobbying", "non-transparent lobbying", "opaque lobbying", "undue legislative process", which encourages corruption.

1. Introduction

The legislative process is inseparable from the various groups and individual members of the public opportunities to represent their interests, resulting in the adoption of legislation and decision-making institutions, transparency and openness, which is a democratic society one of the key principles (Goyal, Sergi 2015; Slapikaitė et al. 2015; Urmonas et al. 2015; Bieliauskaitė et al. 2016). The Treaty on European Union and the Treaty on the functional, of the European Union 2012 / C 326/01, Article 15 establish such provisions: "In order to promote good governance and ensure the participation of civil society, the Union's Institutions, Bodies, offices and agencies shall conduct their work as openly as possible (...). Any citizen of the Union, and any natural or legal person residing or having its registered office in a Member State, shall have a right of access to documents of The Union's Institutions, Bodies, offices and agencies, whatever their medium, subject to the principles and the conditions that without defined in accordance with this paragraph." This regulation establishes the legal democratic behavior standard- interest groups participate in the legislative process through lobbying activities.

To establish a precise definition of lobbying is not simple. The definitions used range from very narrow to very wide approaches. In order to avoid excessive lobbying definition interpretation, authors divulge definition of lobbying, according EU and Lithuanian law regulation. It is argued: *firstly*, EU law norms defining lobbying and lobbying activity are more comprehensive; *secondly*, expert interview was made in Lithuania, *thirdly*, Lithuanian law on lobbying activities are not working.

Agreement between the European Parliament and the European Commission on the establishment of a transparency register for organizations and self-employed individuals engaged in EU policy- making and policy implementation⁹ establishes provisions, what kind activity of interest groups will covered by law regulation: "The scope of the register covers all activities, other than those referred to in paragraphs 10 to 12, carried out with the objective of directly or indirectly influencing the formulation or implementation of policy and the decision-making processes of the EU institutions, irrespective of where they are undertaken and of the channel or medium of communication used, for example via outsourcing, media, contracts with professional intermediaries, think tanks, platforms, forums, campaigns and grassroots initiatives." Lithuania has law on lobbying activities from 2000 y. This Law shall regulate lobbying activities, their control and liability for violations of this Law. The Law shall seek to ensure publicity and transparency, prevent illegal lobbying activities.

The act also provides the definitions of lobbying activities and lobbyists:

1. "Lobbyist "means a natural or legal person recorded in the Register of Lobbyists in accordance with the procedure laid down by this Law". Noticeable, that who wants to get status of lobbyist has obligatory to record in the register. The same practice we can find in EU law regulation of lobbying.

2. "Lobbying activities" means actions taken by a natural or legal person for or without compensation in an attempt to exert influence to have, in the interests of the client of lobbying activities, legal acts modified or repealed, or new legal acts adopted or rejected.

It is important to emphasize, that the EU Agreement lobbying meaning disclosure through activity, which clearly helps to understand the phenomenon of lobbying concept, Republic of Lithuania law on lobbying activities- through lobbyist definition¹⁰.

2. Methodology

In order to characterize lobbying definition in European Institutions and Lithuanian country – was chosen comparative analysis method. The logical analytic method- used to analyze collected information for formation of the intermediate and final conclusions. Document analysis method- taken to obtain information using qualitative

⁹ Hereafter- Agreement

¹⁰ Author's opinion, Republic of Lithuania law on lobbying activities establishes contradiction, leaving legal loopholes (gray zones).

analysis investigating concepts, programs, strategic documents, current legislation, and scientific publications. The main, basic research method of the topic- the individual (expert) interview method was chosen for the qualitative investigation. Obtained material was analyzed using the content analysis method.

3. Expert interview

To obtain information from a wider circle of participants who are concerned with lobbying in a broad sense, the scientific research, interviews were interviewed persons whose activities are related to legislation; research institutions; inspection; participation in the competition project activities financed from public funds, which aims to research the product; state lobbying and public interest in public service harmonization of supervision and institution, which promote civic goal is anti-corruption initiatives and their encourage creation. Table nr.1 shows a map of sample characteristics.

Table 1. Sample characteristics of the elements

Expert nr.	Current Professional Status, represented by sector	ROLE work and experience, a significant issue in terms of exploration	socio-demographic characteristics
1	Professor at the state University, habilitated Ph.D.	Participates in the project and expert activities, and customer surveys	Man, about 50 y.
2	Managerial position at the state University, associate professor.	Managerial work experience in various sectors of education; Working the highest levels of government structures experience, elected politician experience	Man; about 55 y.
3	Chief Official Ethics Commission (COEC)	is independent collegial public institution in charge for the control (supervision) of adherence to the standards of institutional ethics and conduct, regulation of public and private interests in civil service, and control of lobbying activities assigned to its competence by the law	Woman; about 35 y.
4	Member of Seimas, has experience of state university management and associate professor status.	Long-standing members of LRS, experience in various managerial positions in the Seimas groups, Speaker of the Seimas experience; Leading positions at the university experience, teaching experience in higher education.	Man; about 50 y.
5	JCS (private capital), lecturer at private college	Participation in scientific project work experience	Woman; about 32 y.
6	Lobbyist	Officially registered lobbyist since 2011. He is a part of JSC, which is registered in COEC register as lobbyists	Man; about 35 y.
7	JSC (private capital) Associate professor at private college	Participation in scientific project work, invest in research.	Woman; about 50 y.
8	Transparency International Lithuania, lecture of the private university	The main objectives- To form and promote intolerance for corruption in Lithuanian society; systemically gather and spread anti-corruption information; initiate and organize research analyzing the phenomenon of corruption; create learning tools and programmes related to dealing with corruption.	Woman; about 30 y.

(Manion C. 1989), indicates a threefold purpose of the research interview method:

1. Direct tool to get required information.
2. Measure the hypotheses raised in check.

3. Interview in conjunction with other methods can be used to gather information and consideration of other methods.

The obtained material was analyzed using the content analysis method. „Defines content analysis as a research technique for making replicable and valid inferences from data to their context“ (Krippendorff 1980). *Content analysis* is a procedure for the categorisation of verbal or behavioral data, for purposes of classification, summarisation and tabulation. The content can be analysed on two levels. The basic level of analysis is a descriptive account of the data: this is what was actually said with nothing read into it and nothing assumed about it. Some texts refer to this as the *manifest* level or type of analysis. The higher level of analysis is interpretative: it is concerned with what was meant by the response, what was inferred or implied. It is sometimes called the *latent* level of analysis.

Interview object - a) the possible manifestations of lobbying in science b) the possible manifestations of lobbying for funding research project work, c) potential regulatory loopholes and / or advantages. Interview conducted in 2015 of April- September. Each interview was conducted in 60 to 90 minutes. Introductory interview subjects were under investigation to explain the meaning and context. It was also emphasized that the interview is confidential and that the confidentiality of the investigator based on the social scientific ethics. In order to ensure one of the main qualitative research works of "openness" methodological quality principles, informants were asked broad, open, encouraging diversity of opinion surveys.

Interview developed without imposing the term "lobbying", it was guided by the investigator perspective, these promising thematic-story lines: expression of interest groups in the science or research activities; expression of diversity; interest groups manifestations methods, forms; possible environmental performance; examples of situations; the legal regulation of these activities, the existing gaps; improvement of legal regulation in this area, for reasons of transparency, accountability and the rule of equality and pluralism of opinions; examples of good practice.

The beginning of the study and a brief abstract informant familiar with the problems is analyzed in order to show the progress of the interview and thematic- story lines. During the interview argumentative topics were developed, attempts to reveal the problem more deeply. All informants shown willingness to assist the investigation, responded sincerely and fully justified their answers.

Informants' statements analysis allowed identify the following thematic-study topics:

- Lobbying latency problem in scientific activity
- Indirect lobbying manifestations in science
- Expert labor problems of transparency, openness, accountability problem
- Lobbying regulatory loopholes
- Lack of education about the phenomenon of lobbying
- Limited, discriminatory character access to information in legislative process

4. Generalizations

According to interview results, problematic aspects are classified into classes: legal-material; procedural- legal and social - cultural.

Legal - material group classification are based on these thematic lines: “lobbying latency problem in scientific activity”; “indirect lobbying manifestations in science lobbying definition and regulatory loopholes”. It presupposes to improve definition of lobbying, in law system, consolidating the fundamental provisions. In this case, lobbying is perceived as a legislative object. The investigation revealed the existence of non-transparent lobbying character

in research and higher education sector, Lithuanian case. Analyzing the definition of lobbying, the major challenges are to establish definition by law norms, without contradictions and loopholes. Republic of Lithuania law on lobbying activities is not working in practice. (Stankevicius A. et al 2014; Lukosaitis A. 2011). According to this act, activities of non-profit organizations aimed at exerting influence in the common interests of their members to have legal acts modified or repealed, new legal acts adopted or rejected are not covered as lobbying activity, so, do not have duty to disclosure they interest, beneficiaries, target, actors, etc. International research data indicates that they are the largest interest groups to influence the political - legal decisions. When asked which groups match the definition of a 'lobbyist', two-thirds of respondents named trade associations, with public affairs agencies (58%), NGOs were named as lobbyists by more than half of the respondents (51%) and professional organizations (57%) being other common responses. With 26% of respondents across Europe identifying it as the most negative aspect of lobbying, a lack of transparency remains the most prevalent weakness in lobbying practice. Giving undue weight in the process to elites and the wealthy (24%) and not providing neutral information (23%) follow close behind. (Burson- Marsteller. 2014). A broad range of interest groups and their representatives are looking to inform and influence public decision-making, contributing to a generally dynamic democratic environment. A number of actors attempting to influence decisions, from the private, public, not-for-profit and legal fields, do not consider themselves to be lobbying as such, and the activity is frequently called by another name – advocacy, public affairs or interest representation. (Transparency International 2015).

This loophole might be the primary reason why the institute of lobbying in Lithuania is not viable and effective, which exert opaque, defective legislation.

Legal- proceeding group. According to obtained interview data, it covered by this thematic lines: “limited, discriminatory character access to information in legislative process”; “expert labor problems of transparency”; “openness, accountability problem”. Access to information in legislative process is another principle of clear lobbying activity- integrity. This principle is one of the important aspects of fair competition. Based on international scientific research, citizens and interest groups have little opportunity to know who is influencing public decisions, on what issues and how. Although all countries except for access to information laws, in practice, citizens, media or other interest groups face practical hurdles in making successful information request (Transparency International 2015). Countries should enable stakeholders – including civil society organizations, businesses, the media and the general public – to scrutinize lobbying activities. The public has a right to know how public institutions and public officials made their decisions, including, where appropriate, who lobbied on relevant issues. Countries should consider using information and communication technologies, such as the internet, to make information accessible to the public in a cost-effective manner. (OECD 2015). The authors argue that equal and fair access to information must be provided to strengthen the institutional platform that would be available for public scrutiny both economic and technological aspects. Development and implementation information and accessibility of public decision making process, it's very important to ensuring such public initiatives like watchdogs, observers, privet interest disclosure system and content ('legislative footprint', beneficiaries, client, lobbyist, politicians), which ensuring timely access to such information.

Social – cultural aspect- lack of education and understanding about the phenomenon of lobbying. Revealing the contents of this classification, it should be noted that Lithuania is a post-soviet country. Lithuanian social life is a widespread of terms "blatas"¹¹, nepotism, favoritism, protectionism. These phenomena during Soviet era was perceived as a person or horizontal communication using informal exchanges on the basis of trust and already established relationship, as well as friends, relatives to various state-owned goods. „Blato“ has a positive connotation: "help friends", "support", "arranging", so this is not necessarily a mutual relationship, but always - use public resources.(Brandišauskas, D 2005). The informal bureaucratic organizations plays a particularly important role in decision-making post-Soviet societies. These organizations include the informal social relations existing in

¹¹ “Blatas“ russian sociologist (A. Ledencova. 1998) defined as informal contacts and networks to acquire goods and services or the influence to do.

parallel with the formal, but not included in the official rules and codes of conduct. In such friendships can be identified, coalitions, cliques, fractions. These relationships are often associated with kinship, friendship, ethnicity, community and identity - broadly- pragmatic interests. It still plays a very important role in business relations, as well as to make use of state resources in Lithuania. As mentioned informants: “education about lobbying phenomenon, public information about good practice experience, will help to increase knowledge about lobbying and improve both understanding of lobbying and greater transparency in its conduct.”

This phenomenon is the main factor to provoke such negative aspects as corruption and shadow economy.

Sustainable development of entrepreneurial activities requires respective favorable multi-faceted environment (Laužikas et al. 2015, Tvaronavičienė 2015). One of the main factors are the legal and economic. Opaque, illegal lobbying implies flawed legal production and legislative process. Mentioned, that such situation is favorable to emerge manifestations of corruption and the underground (shadow) economy. Interview informants mentioned, that the target of interest groups activity in science and higher education sphere are the allocation of budget funds (EU and national), distributing state orders and credits, access to license activity, state purchasing, expert status with administrative decisions. All these activities are interacting with business and private interest.

According to obtained results, it's possible to identify such consequences directions of non-transparent, non-integrity lobbying activity: *firstly*, monopoly and unfair competitive threats. Competitive activity can result threats to economic security, which is an important component of the country's security (Stankevičius et al. 2015). Security of society is one of preconditions and driving factors of sustainable development (Lankauskienė, Tvaronavičienė 2012); *secondly*, dominance of narrow interest groups in legislative process presupposes manifestations of corruption. Corruption significantly influences stability and security of many countries, undermines democratic and moral principles as well as hampers the economic and political development of the countries (Teivāns-Treinovskis, J. et al 2016). At present, unfair and opaque lobbying practices constitute one of the key corruption risks facing Europe, and six out of 10 European citizens consider their government to be seriously influenced or entirely co-opted by a few vested interests (Transparency International 2015); *thirdly*, this results defective institutional framework (excessive bureaucracy, abuse of public office). Imperfect system of institutional framework has strong bearing on competitiveness and growth. It influences investment decisions and the organization of production and plays a key role in the ways in which societies distribute the benefits and bear the costs of development strategies and policies. For example, owners of land, corporate shares, or intellectual property are unwilling to invest in the improvement and upkeep of their property if their rights as owners are not protected. (World economic forum. The Global Competitiveness. Report 2014–2015; 2016-2017); *fourthly*, imperfect legal system. The role of institutions goes beyond the legal framework. Government attitudes toward markets and freedoms and the efficiency of its operations are also very important: overregulation, corruption, dishonesty in dealing with public contracts, lack of transparency and trustworthiness, inability to provide appropriate services for the business sector and political dependence of the judicial system imposes significant economic costs to businesses and slow the process of economic (World economic forum. The Global Competitiveness Report 2014–2015; 2016-2017).

Conclusions

1. Answering the first question raised at the very beginning of this paper about, we claim, that science sector is active of lobbying activity, which is more latent nature, exerting in indirect forms. Informants do not deny thesis that manifestations of lobbying in science exist.
2. Answering the second question, we argue, that lobbying activity has direct influence sustainable development. It's very important to strengthen social- legal control of legislative process, including public scrutiny, easy access to legal acts projects, clear system disclosure of private interests, turnover, beneficiaries, clients, and other actors. Also mentioned, that non-transparent, non-integrity lobbying negative affecting sustainable development, presuppose corruption and shadow economy.

3. It's possible to conclude, that Lithuanian law on lobbying activities are not working, containing a range of legal gaps and contradictions within it, such as: not clear definition of lobbying; not clear the content of lobbying activity (methods), not clear definition of subject, not clear procedure of ethical behavior. Authors argue, that mentioned provisions should be robust, comprehensive and sufficiently explicit to avoid misinterpretation and to prevent loopholes
4. It's necessary to promote open and ethical lobbying standards and to develop public awareness and understanding about phenomenon of lobbying, forming a positive approach to lobbying.
5. Lobbying phenomenon must be regulated in innovative manner, according to social changes: transition to new systems that are being built on the infrastructure of the digital revolution. It is necessary to pay attention to a new possible nature of lobbying - cyber lobbying.

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Andrius STANKEVIČIUS, Mykolas Romeris University, Faculty of Public security, Department of Law, lector. Research interests: public security, interest groups, lobbying.

ORCID ID: orcid.org/0000-0002-2528-0497



Asta LUKŠAITĖ, JSC “Mitris group”, consultant. Research interests: interest groups, lobbying, sustainable developing.

ORCID ID: orcid.org/0000-0001-9883-4705





ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

**TOWARDS SUSTAINABLE ENTREPRENEURSHIP: ROLE OF NONVERBAL COMMUNICATION
IN BUSINESS NEGOTIATIONS**

Kęstutis Peleckis¹, Valentina Peleckienė², Kęstutis Peleckis³, Tatjana Polajeva⁴

^{1, 2, 3} Vilnius Gediminas Technical University, Saulėtekio Av. 11, LT-10223 Vilnius, Lithuania

⁴ Tallinn University of Technology, Akadeemia tee 3, 12618 Tallinn, Estonia

E-mails: ¹ kestutis.peleckis@vgtu.lt; ² v.peleckiene@vgtu.lt; ³ k.peleckis@vgtu.lt; ⁴ Tatjana.Polajeva@ttu.ee

Received 10 May 2016; accepted 25 August 2016

Abstract. This article examines the importance of being able to read body language signals in business negotiations. Observing physical body changes and gestures can lead to a more or less realistic impression about the opponent, his feelings, mood, thoughts, expectations, intentions and their changes. The most important aspects of non-verbal body language are: posture, clothing, accessories, gestures, eye contact, facial expressions, smile, voice tone, laughter, eye contact, eye signs, the distance between the participants of the conversation, touch, clap, dance, and physiological response — sweating palms or forehead, paleness, acute facial or neck redness, etc. Some of the non-verbal communication signs, or, in other words, body language signals are conscious (either natural or pretended), while others are communicated to the environment unintentionally, with immediate, instant and instinctive response to received information without any thinking. Body language signals in business negotiations are important in several aspects:

- They reveal the other person's or the opponent's physical and emotional state as well as its change;
- They complement, reinforce or weaken the spoken words;
- They enable those, who can read non-verbal communication signs, to determine, whether what was said is true, more or less accurately.

Keywords: nonverbal communication, body language, business negotiations, business conversations.

Reference to this paper should be made as follows: Peleckis, K.; Peleckienė, V.; Peleckis, K.; Polajeva, T. 2016. Towards sustainable entrepreneurship: role of nonverbal communication in business negotiations, *Entrepreneurship and Sustainability Issues* 4(2): 228-240. DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(10\)](http://dx.doi.org/10.9770/jesi.2016.4.2(10))

JEL Classifications: M21, M54.

1. Introduction

Sustainability of entrepreneurial activity depends on numerous factors among which role of innovations, patents are being the most widely discussed and emphasized (e.g. Razminienė et al. 2016; Tvaronavičienė et al. 2015; Ignatavičius et al. 2015; Tvaronavičienė, Černevičiūtė 2015). Efficiency of resources use, especially energy use as

well are considered as drivers and determinants of sustainable and competitive performance of business companies, and ultimately, countries (e.g. (Tvaronavičienė 2012; Raudeliūnienė et al. 2014; Lapinskienė et al. 2014; Tvaronavičienė et al. 2016). We admit that those factors and many others, especially, management techniques and style affect results of various businesses (Fuschi, Tvaronavičienė 2014; Bistrova et al. 2014; Mentel et al. 2016). Meanwhile such managerial abilities as communication techniques and impact of nonverbal communication on sustainable entrepreneurship, to our minds, remain underappreciated.

In this papers we will present our critical view to role and peculiarities of nonverbal communication for succesfull negotiations in business. Business communication, negotiations and conversations, as well as human interaction in general, is based not only on transferred information, but also on how that information was presented and what voice nuances were used. Conscious or unconscious body signals that we send as we speak are important as well. As people engage in communication, their bodies send numerous messages-signs of body language. According to Allan and Barbara Pease, what is most important is not what you say, but the way you look while doing that (Pease, Pease 2012). Joe Navarro (Navarro 2007) noted that non-verbal communication, also often referred to as non-verbal behaviour or body language, is a way to convey information — just as a spoken word, except that we do that by facial expressions and gestures, touching (haptics), physical movements (kinetics), posture, body decoration (clothes, jewellery, hairstyle, tattoos), even voice tone, its timbre and strength (no matter what the person says). Joseph Messinger emphasized that the basis of social credibility — the effect of movement — significantly surpasses the impression we make by speaking or even our appearance. The message transferred by gestures enriches the speech, giving a special emphasis on the key words (Messinger 2013). Thus, observing physical changes of the human body and gestures, allows us to create a more or less realistic impression on the person's state of being, mood, feelings, thoughts, expectations, intentions and their changes.

2. Signs and signals of body language and determining factors

The beginning of serious research on non-verbal language is related to the book *Body Language*, published by Julius Fast in 1970 (Fast 1970). Albert Mehrabian — a pioneer in research on body language (Mehrabian 1971; Mehrabian 1972; Mehrabian 2009) — found that we convey 7 % of information by words, 38 % — by voice characteristics, and about 55 % of the information is conveyed by using non-verbal language. A good negotiator must be conscious of and manage his non-verbal language, understand what he shows to his opponent, as well as know how to understand his opponent's body language and notice, when his verbal and body language contradict or supplement each other. These are very important impulses that can drastically change the course of the negotiations and their final outcome. The researchers Allan and Barbara Pease examined thousands of entrepreneurs and found out that about 60-80 percent of entrepreneurs watch body language and form their opinion on a new person as fast as within the first four minutes. Their research also showed that stronger arguments win negotiations over telephone, but this doesn't count when meeting face-to-face, because final conclusions are made based on what we see, instead of relying on what we hear (Pease, Pease 2012).

The ability to understand the body language of another person or an opponent, as well as to predict, what he thinks and feels, how he reacts and what he is going to do, is very important in business communication, business negotiations and business meetings. In order to develop this ability you need to put a lot of effort: to study the theory and apply it in practice. However, you also must pay attention to the ratio of seeing and listening (hearing). According to Joseph Messinger, our listening methods are not ready to understand two so different ongoing activities as watching and listening. We can't focus on two different sensory processes. We instinctively distinguish two automatisms — listening and seeing, but we can't put them together into one joint listening process (Messinger 2013). In order to learn how to listen and see simultaneously, we need to focus additional attention and put some extra effort, which will become additional communication capabilities in the future.

Joe Navarro emphasizes the importance of reading body language, stating that non-verbal communication can reveal what someone truly thinks, feels and intends to do. For this reason, it is sometimes referred to as an *eloquent behaviour*. People are not always aware that they also communicate without speaking, so their body language is often much more honest, because in order to achieve their goals people carefully think over their words. If you observe someone's non-verbal behaviour and understand what he feels, plans and what he intends to do, or if you figure out the meaning of his words, then you decipher his tacit language and can take advantage (Navarro 2013). Body language is very informative and sends many signals, but they are ambiguous, difficult and sometimes even impossible to interpret or shouldn't be interpreted. The accuracy and quality of the interpretation depends on the interpreter's knowledge and experience.

Body language or non-verbal communication includes many body language elements. Non-verbal body language involves a lot of important aspects, such as posture, clothing style, accessories, gestures, facial expressions, smile, voice intonation, laughter, eye contact, the distance between the communicating parties, touch, clap, dance, and physiological responses — sweating palms, forehead, paleness, acute facial and neck redness, etc. It should be noted that some of the signs of non-verbal communication can be sent consciously (natural or fake signs, signals), while the other part of the body signals are unconscious, produced as an instant, instinctive reaction to received information without any thinking. However, all non-verbal communication is controlled by the human brain. Joe Navarro emphasizes the importance to understand that the brain controls the entire behaviour, both conscious and unconscious. This assumption is the cornerstone of our understanding of the entire non-verbal behaviour. There is no action — from scratching your head to composing a symphony — which wouldn't be governed and managed by the brain (with the exception of involuntary muscle reflexes). Thus, based on non-verbal behaviour, we can understand what the brain wants to show (Navarro 2013). We can try to conceal our feelings or emotions, but we will send out some non-verbal signals nevertheless. It is extremely important to notice and understand these reactions.

Human response to the impact of the environment is associated with emotions and survival. During thousands of years of human evolution, the brain has developed a simple system of responding to danger — **stop, fight or flight** — and rooted it into the nervous system (Navarro 2013). According to Joe Navarro, “animals and people respond to danger in the same way: at first they freeze, then run and, finally, fight. If we truly responded to danger by fighting or running away, we would walk around in bruises — all beaten and exhausted. To freeze, when facing a threat is the most effective response” (Navarro 2013).

We freeze not only when facing danger, but also, e.g. when we hear a doorbell in the middle of the night. The forms of **freezing** have changed during the long years of human evolution and are currently much more subtle. Many people encounter the **phenomenon of freezing** during job interviews, after scolding, during interrogation about things which, in their opinion, can put them in trouble, in cases, when you just want to become “invisible” and other situations. People **freeze**, when, e. g., they are caught cheating, stealing or lying: in case of a threat or revealed lies they react in the same way as our ancestors did — by **freezing** (Navarro 2013). A brief pause enables to assess the danger and make the decision for further action.

When freezing is not enough and danger remains present, or when freezing becomes not the best option (for example, when the threat is too close) the brain turns on the second response: **flight**. The purpose of this response is to escape or at least get as far away from danger as possible (Navarro 2013). During human evolution the response of flight has also acquired a variety of more subtle forms, but its essence it remains the same — to get away, **distance yourself** from or to **avoid** unwanted people or situations. Seeking to avoid a conversation with someone unwanted we may turn away and pretend that you don't see him. Avoidance can take many forms: closing or rubbing your eyes, or covering your face with your hands (Navarro 2013). Avoidance also manifests in increasing the distance between you and the other person by sitting back, reclining, placing some things on your lap (such as a computer, handbag), turning your legs towards the nearest exit, etc. During business negotiations upon hearing an unattractive

proposal or feeling threatened, the negotiator of one side can move away from the representative of the other side of the negotiations, or close his eyes, rub his eyes, hide his face in his hands or turn his feet towards the door. According to Joe Navarro, this behaviour does not signify cheating, but rather indicates that this person feels uncomfortable. The old flight response today manifests as an attempt to increase the distance. Thus, if your business partner increases the distance between you and him at the negotiation table, it means that he doesn't like something (Navarro 2013).

If people facing danger cannot stay unnoticed by freezing and cannot escape by flight, the only thing for them to do is to *fight*. The response of fighting is the last tactical tool to stay alive by using aggression (Navarro 2013). In the course of the evolution not only people, but also all mammals developed a strategy to turn their fear into anger. However, in modern world this type of behaviour is not acceptable (and may even conflict with the law), so, aside from the primitive response of fighting, people have developed several more subtle fighting forms: disputes, quarrels, insults, unfounded accusations, belittling the opponent's status, provocation, bullying — all these are manifestations of hostility, which replace actual fighting in the modern day (Navarro 2013). Hostility to another person may be showed by posture, gaze or by violating another person's personal space. A sharp clash boils emotions, which hinder concentration and clear, objective thinking. Sometimes during business communication, negotiations or conversations negotiators provoke the other side's frustration and anger on purpose, with the aim to reduce the opponent's cognitive abilities and the ability of full, objective assessment of the situation.

Body language in business communication and negotiations is important for several reasons:

- It reveals the opponent's physical and emotional state, as well as its evolution;
- It complements, reinforces or weakens the spoken language;
- It enables those, who know how to read non-verbal communication signals, more or less exactly determine, whether the opponent tells the truth.

According to Allan and Barbara Pease, "the basic communication signals are the same all over the world. When people are happy, they smile, and when they are sad or irritated — they frown or look angry. They agree or say "yes" by nodding their head. Apparently, nodding is innate, because blind people also do that. Shaking one's head in denial is also an almost universal gesture, learned in infancy (Pease, Pease 2012). However, aside from innate and genetically-determined body language, there are also non-verbal communication signs, determined by the following factors:

- *Nationality* — the same gestures in different nations may have different meanings;
- *Culture* — ethics, etiquette knowledge, educational level and other cultural aspects determine the arsenal of body language signals;
- *Profession* — a light handshake may be determined by the occupation, which requires to take particular care of one's fingers;
- *Acting skills* — many people have greater or lesser acting skills and know how to play one or another role not only using words, but also body language;
- *Temper, energy* — people of different temper or with different energy levels use a different amplitude and a different set of body language signals, which vary in their intensity and dynamics;
- *Health condition* — someone feeling ill has a different look in their eyes, a different voice and slower gestures (on the other hand, some disorders manifest in increased emotionality, excitability or irritability);
- *Social status* — people with higher status usually use fewer gestures and the gestures are more refined; they also move with dignity and slower than those with less power; in conveying information they mostly rely on verbal language;
- *Belonging to a group of people* — non-verbal behaviour may be influenced by the group's traditions, norms and rules;
- *Age* — age can change the speed of a person's movements;

- *Coordination of non-verbal signals* — people usually show their condition by more than one signal. There should be a certain harmony between them, otherwise you could suspect your interlocutor of being dishonest;
- *Opportunities to send and receive signs of non-verbal communication* — physical restrictions between people impede smooth communication.

3. Comfort, discomfort and ways to compose oneself in body language

In order to understand the body language of your opponent, you should not only monitor his movements and gestures, but also how they change in the course of business conversation. The changes in the opponent's body language mark the changes in his position. Therefore, in the processes of business communication, negotiations or business conversations you must carefully monitor when and why something happens. The body of your business communication partner, the opponent is like the litmus test, showing whether your actions and measures are correct and effective or not. It is impossible to monitor all of the opponent's movements and facial expressions, because during business negotiations and conversations you also need to think and about other things. However, what is most important is to capture those moments, when your opponent's reactions change according to your reasoning or counter-argumentation, especially, if these changes are positive or negative.

Joe Navarro says that it's important to capture the way people behave, when they feel *comfortable* and *uncomfortable* and use that in order to learn to understand what they feel, think and intend to do (Navarro 2013). When someone is in their comfort zone (feels well), his body language shows their good mental and physical condition, manifesting in self-confidence, satisfaction, positive emotions and positive feelings. When someone is experiencing discomfort, their body language shows stress, lack of confidence and bad internal state.

However, the human brain is programmed in a way to make us pursue safety (or comfort) and, if possible, avoid risks (or discomfort). Our brain and body act together, soothing and giving confidence in safety (Navarro 2013). Joe Navarro refers to this as *self-soothing behaviour* (Navarro 2013). He argues that understanding how the response of freezing, flight or fight influences non-verbal behaviour, is only a half of the job, because the response (especially to threatening or negative situations) is followed by the *self-soothing behaviour* — the brain stimulates the body to engage in consolatory (soothing) behaviour. These signs are clearly visible and are easy to understand. It is important to notice and pinpoint them in a “real situation” (Navarro 2013; Navarro 2007). According to Joe Navarro, self-soothing behaviour is not unique to humans. For example, in order to calm down dogs and cats groom their fur and each other. The options of self-soothing behaviour for people are much more diverse. Sometimes it is very obvious and sometimes — hardly noticeable. Asked to give an example of self-soothing behaviour, most people think of a child sucking on his thumb. Adults usually find less obtrusive and more socially-acceptable methods (for example, chewing gum, gnawing on a pencil or a pen). Many people don't even notice such subtle behaviour, which helps them calm down, or don't understand its importance in detecting other people's thoughts and feelings. What a pity! It is crucial to learn to recognise and identify signs of self-soothing in order to understand non-verbal behaviour. Why? Because self-soothing behaviour can tell a lot about people's mental state (Navarro 2013).

In business communication or negotiations, it is important to notice your opponent's signs of self-soothing behaviour, which would signify that he feels constrained or has a negative attitude towards our actions and words, because “after actions that signify discomfort (e.g., sitting back away from the interlocutor, giving a disapproving look, crossing one's arms or clenching one's fists) the brain commands hands to take some self-soothing action” (Navarro 2013). Based on his experience Joe Navarro says that “touching and (or) stroking your neck is one of the most important and most frequent self-soothing movements used in response to stress” (Navarro 2013). In order to calm down women often cover or touch their neck dimple — they suffer, experience fear and discomfort because of lying or hiding information (Navarro 2013). Joe Navarro believes that self-soothing behaviour is much more significant and more reliable than attempts to determine whether a person is telling the truth. They help us

understand, what topics make people excited or anxious. As you learn this, it often helps to find out carefully concealed information, which may give new insights (Navarro 2013).

The mechanism of self-soothing behaviour works like this: the brain sends a message, requiring immediate soothing, and hands instantly react, performing an action, which helps to feel well again (Navarro 2013). Everyone has their own habits of self-soothing behaviour: some chew gum, others smoke, eat more, gently massage their neck, run their hand over their face, lick their lips, swipe their tongue on their cheek inside their mouth, inflate their cheeks and then slowly exhale, rub their chin, caress their face, touch some objects (a pencil, pen, lipstick, wristwatch, etc.), women often play with their hair, men brush over their chest or straighten their tie. According to Joe Navarro, touching one's face, head, neck, shoulder, arm, hand or leg in response to a negative stimulus (such as a hard question, a difficult situation or stress) should be considered as self-soothing behaviour. Stroking on any part of your body doesn't help to solve problems, but soothes and relieves your anxiety. Men usually touch their face, women — neck, clothing, jewellery, arms and hair (Navarro 2013). As you notice your opponent's self-soothing behaviour during business communication or negotiations, you should ask yourself: "Why is this person soothing himself?". And, most importantly, "the ability to link self-soothing behaviour with particular stressors can help to gain a much better understanding of the order to person's thoughts, feelings and intentions" (Navarro 2013).

In learn more about your opponent's favourite self-soothing actions, you should follow several rules (Navarro 2013):

1. Observe the self-soothing action. If you focus, eventually looking for signs of body language will become easier.
2. Identify the basic self-soothing method. Then you will learn to notice, when the use of that method increased or intensified and will be able to take appropriate action.
3. If you noticed a self-soothing gesture, stop and ask yourself, "What made him do this?" It is clear that this person is worried. Your task as a collector of non-verbal information is to reveal the reason.
4. Remember, that people almost always use self-soothing actions to calm down after experiencing stress. Talking of whether a non-verbal sign speaks the truth, remember that as you move from the feet to the head, faithfulness to the truth decreases. According to Allan and Barbara Pease, the further the body part is away from the head, the more often we tend to forget it. For example, most people are aware of their facial expressions and gestures. We could even identify some of them, like "putting on a brave face", having a "disapproving look", "enduring the suffering" or "looking happy." We have a little less information about arms and hands, even less — about the chest and stomach, followed by legs, and we most usually forget about your feet. Legs show people's attitudes, as most people seem to be unaware of what they do with their limbs and they also don't use them for deliberate deceiving gestures as they do with their face. For example, a person may look focused and composed, but his feet keep kicking the air in order to escape (Pease Pease 2012). According to the study on managers, conducted by Allan and Barbara Pease, "regardless of gender, lying managers unconsciously tend to increase their leg movement. The majority of the managers had put on a "poker face" and tried to control their hands, but almost no one knew what they were doing with their feet. These results were confirmed by the psychologist Paul Ekman, who found that lying increases lower body movements and observers have more success in exposing lies when they see the liar's body. This explains why business leaders feel more comfortable hiding behind their desks with a solid front. Glass tables cause more stress than massive ones, because through the glass surface you can see the legs, making it more difficult to control yourself (Pease, Pease 2012). So, legs are the most "honest" body part.
5. The ability to link a self-soothing action with certain factors that caused the stress can help you understand your interlocutor better.
6. In some cases, in order to gain a better understanding of your interlocutor's thoughts and intentions, you may say or do something in order to make sure, if this is what puts this person under stress (as indicated by increased self-soothing behaviour).
7. Note, which place of the body is used for self-soothing behaviour. This is very important, because the greater the stress, the more the person will be caressing his face or neck.

8. Remember, the stronger the stress or discomfort, the greater the likelihood that a person will take *self-soothing action*.

The ability to observe and identify *self-soothing behaviour* is an important measure to determine, whether your interlocutor feels comfortable or not. The *self-soothing behaviour* also tells a lot about his emotional state, feelings, intentions, expectations and the degree of their fulfilment, or planned actions.

4. Observing and interpreting body language

Joe Navarro provided 10 rules to follow in order to be successful in observing and decoding non-verbal communication (Navarro 2013):

1. *Become an insightful observer of the environment.*

Joe Navarro states that “attentive *listening* is important to understand what was said, while careful *monitoring* is crucial in order to understand people’s body language”. According to him, “focused *monitoring* is necessary to understand people and correctly interpret the signs of their non-verbal behaviour” (Navarro 2013). Many people lack the so-called understanding of the situation, because nobody teaches that at primary schools, gymnasiums or universities (Navarro 2013). However, luckily, perceptiveness can be acquired — this skill can be developed by learning and applying knowledge in practice. If you’re unobservant, don’t worry. This weakness can be eliminated, if only you will take time and put some effort for diligent observation of the surrounding world (Navarro 2013). According to Joe Navarro (Navarro, 2013), “observation — focused observation — must become a lifestyle. Being passive will do no good. It is a conscious, deliberate behaviour, which requires effort, energy, concentration and constant practice. Attentiveness is like a muscle: training makes it harder and if you don’t use it, it will become weak. Exercise your muscle of attentiveness and you will be able to understand the world better (Navarro 2013).

2. *Observation in a certain context is the best way to understand non-verbal behaviour.*

In order to understand non-verbal behaviour in real life and real business environment, we need to understand the real context. Then it will become easier to understand, what a particular behaviour means. For example, crossed arms over one’s chest during negotiations may indicate that a person is trying to distance or block himself from the information received and disagrees with the opinion that you provided. The same action carried out at a bus stop in the middle of winter while waiting for a bus, will mean something different — the desire to maintain warmth and fight against the cold.

3. *Learn to recognize and decipher the universal non-verbal behaviour.*

Universal signs of non-verbal behaviour are characteristic to almost all people. According to Joe Navarro, “certain body language is considered universal, because it is used by most people. For example, when people press their lips in a thin line, this is a clear sign that they are worried and that something is wrong” (Navarro 2013). For example, sweating palms indicate nervousness and tension, raised eyebrows — surprise and doubt, narrow or angry gaze — frustration, anger, while touching one’s mouth with fingers, pencil or a pen shows that the person is worried.

4. *Learn to recognize and understand unique non-verbal behaviour.*

Aside from universal non-verbal behaviour, some signs are unique, distinct and specific to a particular person. The longer you know your business partner, opponent or interlocutor, the easier it will be for you to detect and identify his unique non-verbal behaviour and make appropriate decisions.

5. *As you communicate with people, try to figure out their basic behaviour.*

Joe Navarro draws attention to the fact that “in order to understand the basic behaviour of the people that you communicate with on a regular basis, pay attention to how they look, how they sit, where they keep their arms, how they keep their legs, their posture and facial expressions, the angle they keep their head in and even where they normally put or keep their belongings. Learn to distinguish between a calm and a tense face. As you learn to see normal behaviour, you will gradually start to notice and understand abnormalities (Navarro 2013).

6. *As you observe people try to look for several eloquent signs — behavioural patterns that occur at the same time or one after the other.*

According to Joe Navarro, your ability to understand people will improve as you learn to notice a few or a group of eloquent non-verbal signs. These signals go together as pieces of a puzzle. The more of them you have, the greater the possibility of arranging them in a full picture (Navarro 2013).

7. *Look for changes in a person's behaviour, because they may indicate a change in thoughts, feelings, interest or intentions.*

Joe Navarro says that "sudden changes in behaviour can help reveal, how people process information or adapt to exciting events. <...> Under certain circumstances changed behaviour might show the person's interest or intentions. Close monitoring of these changes can predict future actions and help to gain advantage, especially if those actions could harm you or someone else (Navarro 2013).

8. *It is equally important to learn how to notice false or misleading non-verbal signs.*

The ability to distinguish between real and fake signals may be obtained only through practical monitoring experience. Joe Navarro states that you should not only focus on monitoring, but also carefully assess what you see (Navarro 2013).

9. *Being able to distinguish whether people feel free or not, will help to focus on the most important elements of behaviour in order to decode non-verbal communication.*

According to Joe Navarro, you should look for two major things in human behaviour: *comfort* and *discomfort*. If you have any doubt regarding the real meaning of someone's behaviour, ask yourself, if it looks like comfort (e.g. satisfaction, happiness, relaxation) or discomfort (anger, sadness, stress, anxiety, tension) (Navarro 2013).

10. *Don't be obtrusive in your observations.*

Joe Navarro draws attention to the fact that "if you want to use non-verbal behaviour, you must closely look at people and decipher exactly what their behaviour means. However, you should be careful and avoid staring like many beginners do. Don't be intrusive. The best strategy is to watch people, when they are unaware of this, in other words, without drawing any attention to yourself. Refine your observation skills until your efforts bring not only fruit, but also nobody notices that they're being watched. It all depends on practice and perseverance" (Navarro 2013).

Understanding non-verbal behaviour and its interpretation is not simple. Attempts to guess one or another sign of non-verbal communication may often be faulty as the same sign can have many meanings. According to Allan and Barbara Pease, scratching your head may convey sweating, uncertainty, dandruffs, forgetfulness, lies and other things (Pease, Pease 2012). In order to be correct in interpreting non-verbal communication, you should follow three rules of sign interpretation defined by Allan and Barbara Pease (Pease, Pease 2012):

1. *Read groups of signs.*

According to Allan and Barbara Pease, "both spoken and body language consists of alleged words, sentences and punctuation. Every gesture is similar to a word that has many different meanings. The meaning of words is revealed in combining them into sentences. Gestures form groups or, in other words, body language sentences, thus reliably showing personal feelings or attitudes. In order to be sure about the meaning of some gesture, the non-verbal sentence should consist of at least three groups of gestures. Insightful people can read non-verbal sentences and carefully line them with what the person actually says (Pease, Pease 2012). According to Allan and Barbara Pease, the body language sentence, "I don't like what you say" (or "I disagree") usually goes with the gesture of putting one's hand to the face, with the index finger touching the cheek, the middle finger covering the mouth and the thumb holding the chin. Another critical example of the listener's disposition is crossing one's legs, pressing one's hand against one's chest (defence) and lowering one's head and chin (disfavour/hostility) (Pease, Pease 2012).

2. *Look for matches.*

In order to create a reliable impression, you should monitor sign groups and compare them to verbal language. According to Allan and Barbara Pease, studies have shown that non-verbal communication is nearly five times more effective than the verbal channel (Pease, Pease 2012). Verbal and body language discrepancies can be illustrated by the following example: let's say some politician is passionately boasting about being attentive and supporting the ideas of the youth, but if he has his hands crossed over his chest (defence) and his chin lowered

(adversity/hostility), will you believe him? And if he was trying to convince you that he's good and caring, but would just keep hitting the tribune with his fist? (Pease, Pease 2012)

We use our body language and words to emphasize our statements. Emphasizing the importance of our words we raise our voice tone or repeat them. As we speak we also use our body — eyebrows, head, hands, arms, torso, legs and feet — to emphasize what is important or in order to give our words an emotional tone. If people speak honestly, the emphasis is considered to be a universal body language. Thus the brain participates in the conversation, communicating to the others that we are confident in our words. While in an opposite situation the brain doesn't support our words and we put a weak emphasis on our words or don't emphasize them at all. *When people lie, they don't emphasize their words.* In order to decide, what to say and how to deceive, liars use cognitive functions of the brain, but rarely think of how to present their lies. When someone tries to invent some story that is only similar to the truth, the emphasis seems to be artificial and delayed; liars rarely highlight what is important, usually focusing on relatively minor things (Navarro 2013; Lieberman 1998). In order to figure out between truth and lies, the body language can be even more accurate and useful than words. People are used to using their hands and emphasizing their claims with hand gestures, they sometimes even start thumping on the top of the table in order to give more weight to their words. Others highlight their words with their fingertips, making gestures or touching some objects. Hand movements complement honest words, expressing thoughts and feelings. In order to highlight the message, we usually raise our eyebrows and open your eyes wide (Knapp, Hall 2002; Navarro 2013; 2007 Navarro).

And on the contrary: people fail to emphasize their words or don't really believe in what they say, when they speak hiding their mouth behind their hand or talk with an indifferent facial expression. When people don't believe in what they say, they control their facial expressions, limit their movements and perform other actions that create a distance between them and their interlocutor. Liars often pretend to be thinking, for example, they support their chin on their palm or gently stroke their cheeks as if thinking of the answer; this behaviour is completely opposite to that of honest people. A liar needs time to evaluate what he has said and how his words could be interpreted (Knapp, Hall 2002; Navarro 2013; Navarro 2007).

3. Associate gestures with the situation.

All gestures should be evaluated according to the situation and context. For example, crossing one's arms on the chest during business negotiations may signify "defence" and an attempt to distance from the opponent's ideas. While someone crossing his arms while waiting at a bus stop in a cold winter may simply be trying to keep his body warm. According to Joseph Messinger, "80 % of your body movements or postures change their meaning based on the context, or they are simple irrelevant gesticulation, with the exception of repetitive movements, that are unchanging no matter of the context. This means that you must think carefully before evaluating or explaining a certain movement (Messinger 2013).

Studying body language in business negotiations and conversations benefits from the opinions of Samy Molcho, who noticed that "everything, what people feel ... very accurately reflects on their body language. Sentimental feelings make us *open up* or *get away* from the surrounding situation, causing such feelings as fear, preparation for flight, evasiveness, getting away from the coveted receptive (open to the world around) and natural behaviour. All the negative feelings that take over you — when you feel underestimated, insulted for lack of attention to you as a person, or to what you have to say — all of these grievances creates our energy barriers. This, unfortunately, means that from this moment your open behaviour is severely impaired. The flow of information between the sender and the recipient is terminated. Therefore, I rely on the fact that success depends on the ability to find an emotional access to your partner or interlocutor, and the ability maintain this connection, because my personal success depends on whether I am able to motivate people. But, this mechanism works only if I really understand and have a serious approach to not only my personal goals, but also other people's aspirations. Thus, I have to make my interlocutor believe that if he stands with me, he will fulfil all of his desires and expectations. In short: in order to "conquer" other people, you have to get into their shoes and try to find out their wishes and greatest desires, find out what motivates them, encouraging them to act, and what could hinder their actions. If you do manage to get this

information, the only thing remains is to ask yourself: how could I remove the obstacles that hinder their enthusiasm, thus preventing them from going towards success with me?" (Molcho 2006).

Conclusions

1. Business communication, negotiations and conversations, as well as human interaction in general, is based not only on transferred information, but also on how that information was presented and what voice nuances were used. Conscious or unconscious body signals that we send as we speak are important as well. Observing physical changes of the human body and gestures, allows us to create a more or less realistic impression of the person's state of being, mood, feelings, thoughts, expectations, intentions and their changes. This can be useful in choosing and implementing the measures of influence for the other side of the negotiations.

2. Body language in business communication and negotiations is important for several reasons:

- It reveals the opponent's physical and emotional state, as well as its evolution;
- It complements, reinforces or weakens the spoken language;
- It enables those, who know how to read non-verbal communication signals, more or less exactly determine, whether the opponent tells the truth.

3. A good negotiator must be conscious of and manage his non-verbal language, understand what he shows to his opponent, as well as know how to understand his opponent's body language and notice, when his verbal and body language contradict or supplement each other. These are very important impulses that can drastically change the course of the negotiations and their final outcome.

4. The ability to understand the body language of the other person or an opponent, as well as to predict, what he thinks and feels, how he reacts and what he is going to do, is very important in business communication, negotiations and meetings. In order to develop this ability you need to put a lot of effort, study the theory and apply it in practice. Body language is very informative and sends many signals, but they are ambiguous, difficult and sometimes even impossible to interpret or shouldn't be interpreted. The accuracy and quality of the interpretation depends on the interpreter's knowledge and experience.

5. Body language or non-verbal communication includes many body language elements. Non-verbal body language involves a lot of important aspects, such as posture, clothing style, accessories, gestures, facial expressions, smile, voice intonation, laughter, eye contact, the distance between the communicating parties, touch, clap, dance, and physiological responses — sweating palms, forehead, paleness, acute facial and neck redness, etc. It should be noted that some of the signs of non-verbal communication can be sent consciously (natural or fake signs, signals), while the other part of the body signals are unconscious, produced as an instant, instinctive reaction to received information without any thinking.

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Kęstutis PELECKIS. Professor, Doctor of Social Sciences (economics) at the Department of Enterprise Economics and Management, VGTU. The author of more than 100 publications. Research interests: economic growth, sustainable development, increase in the efficiency of business meetings and negotiations. ORCID ID: orcid.org/0000-0001-9886-2431

Valentina PELECKIENĖ. Associate Professor, Doctor of Social Sciences (economics) at the Department of Social Economics and Management, VGTU. The author of more than 70 publications. Research interests: economic growth, sustainable development, increase in the efficiency of business meetings and negotiations.

Kęstutis PELECKIS. Lecturer, Doctor of Social Sciences (management) at the Department of International Economics and Business Management, VGTU. The author of more than 50 publications. Research interests: business negotiation strategies, international business negotiations, increase in the efficiency of business meetings and negotiations.

Tatjana POLAJEVA. Associate Professor, Doctor of Social Sciences at Tallinn University of Technology, School of Economics and Business Administration, Department of Finance and Economics, Chair of Theoretical Economics. The author of more than 70 publications. Research interests: economic growth, sustainable development.

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ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

ISSN 2345-0282 (online) <http://jssidoi.org/jesi/>

BUSINESS VALUE OF INTELLECTUAL PROPERTY IN BIOTECH SMEs: CASE STUDIES OF LITHUANIAN AND ARIZONA'S (US) FIRMS

Mindaugas Kiškis¹, Tadas Limba², Gintarė Gulevičiūtė³

^{1,2,3} *Mykolas Romeris University*
Ateities str. 20, 08303 Vilnius, Lithuania

*E-mails:*¹ mkiskis@mruni.eu; ² tlimba@mruni.eu; ³ gintare.guleviciute@mruni.eu

Received 10 March 2016; accepted 20 September 2016

Abstract. The paper presents the limited quantitative and qualitative analysis of the biotechnology industries in Lithuania and Arizona (US) focusing on the role of intellectual property for the business income of the small and medium firms (SMEs). The paper also discussed theoretical aspects of the role of intellectual property in the biotech SMEs, presents empirical data on the SME intellectual property holding, employment and income data in Lithuania and Arizona based on the conducted case analysis. In depth analysis of the intellectual property, employment and revenue profile and correlations of the selected biotechnology firms are provided. Case analysis focused on patents, which are dominant and easy to study public form of intellectual property in biotechnology firms. Arizona biotechnology firms were found to especially capitalize on patents, even if the number of employees is small, while in Lithuania biotechnology firms appear to lack clear focus on patents and instead have non-innovative intellectual property, such as trademarks. This trend is the strongest in the small firms (by the number of employees). Analysis suggests that business value of intellectual property is much higher in Arizona, and is not sufficiently ascertained in Lithuania. Analysis also shows that biotech SMEs in the US benefit from the patent focus and derive significant business value from patents, while the benefits of dispersed approach to intellectual property in Lithuania are uncertain. The authors suggest that biotech SMEs in Europe may benefit from focused patenting.

Keywords: intellectual property, patents, technology, biotechnology, SMEs

Reference to this paper should be made as follows: Kiškis, M.; Limba, T.; Gulevičiūtė, G. 2016. Business value of Intellectual Property in Biotech SMEs: case studies of Lithuanian and Arizona's (US) firms; *Entrepreneurship and Sustainability Issues* 4(2): 241-254.

DOI: [http://dx.doi.org/10.9770/jesi.2016.4.2\(11\)](http://dx.doi.org/10.9770/jesi.2016.4.2(11))

JEL Classifications: K39, L26, L65

1. Introduction

Intellectual property rights may be described as a number of distinct property related rights with respect to intangible virtues, such as patents, copyrights, trademarks, plant varieties, not patented innovations and so on (Rezk et al. 2015; Rezk et al. 2016; Pauceanu 2016; Lace et al. 2015; Laužikas et al. 2015; Hofmann, Prause 2015; Lavrinenko et al. 2016; Ignatavičius et al. 2015). Intellectual property protection determines how knowledge is produced, owned and distributed (Muzaka, 2012) and is generally described as the control of the use of the protected knowledge in the market (Štilis et al, 2016). In different countries, businesses and technology areas the role of intellectual property varies. Biotechnology is an area, where business value of intellectual property is especially important. This article analyses business value of intellectual property on the assumption that in technological firms value of the firm is defined by its' intellectual property and human capital, and this value is normally reflected in corporate earnings.

Researchers investigate what form of intellectual property is most appropriate for biotechnology firms and why specific forms are chosen. Competition between firms is growing due to globalization and business value of intellectual property may be a big advantage for not letting followers in an industry to copy the technology of the leader. Existing research shows that patent protection is desirable, however it is also very expensive and complicated. Thus patent focus is optimal if the firm is active in the market. Optimal policy to protect intellectual property of a firm involves market-dependent protection, since intellectual property rights inherently provide greater protection to technology leaders than those that are close to their followers. This market supported protection to the firms that are further ahead in their R&D, compared to their followers increases the R&D incentives (Acemoglu, Akgigit, 2011). By employing intellectual property rights firms may increase financial assets, commercial viability, attract new investments, as well as develop new products and services (Ryder, Madhavan, 2014). For these reasons it is essential for a modern firm to select appropriate intellectual property rights for their existing technology.

The background for the paper is the case analysis of the Lithuanian and Arizona State biotechnology firms had been conducted from the perspective of the most appropriate intellectual property protection form for their intellectual assets.

Scientific issue at the heart of this paper is defined by a lack of scientific research in the comparison of the business value of intellectual property between different countries. United States has high global intellectual property business conversion, while many European countries are often considered as having problems in commercialization of the intellectual property rights. Less innovative intellectual property rights, such as trademarks, instead of patents, seem to be more accessible to the European firms. Case analysis of Arizona (US) and Lithuania biotechnology firms allows comparison of the different strategies and possibilities of intellectual property business role.

The goal of the research is to provide empirical analysis of the biotechnology business cases by presenting the situation of intellectual property business value in Lithuania and Arizona (US). The goal will be achieved through the following set of tasks such as theoretical aspects of business value of intellectual property analysis, presentation of SME intellectual property business value in Lithuania and Arizona State by conducting case analysis.

Statistical analysis, comparative empirical analysis, phenomenological, quantitative and qualitative analysis methods are used for the research presented in this paper.

2. Theoretical aspects of intellectual property business value

It is argued in scientific literature that intellectual property protection differs across countries (Jandhyala, 2015; Kim, et al., 2012; Lee, Mansfield, 1996; Henkel, 2014). Especially across developed and developing countries. Lee, Mansfield (1996) presented empirical studies of intellectual property rights in the developing countries and stressed

out that firms in developing countries should be convinced that intellectual property protection is useful for the business and essential in order to break into the international marketplace. Using a panel dataset of over 70 countries, it was concluded that patent protection is important for innovations and that patentable innovations contribute to economic growth in developed countries, but less so in the developing countries (Kim, et al., 2012). Policy-makers usually assume a positive relationship between intellectual property rights and economic growth, but the empirical evidence on this question is rather inconclusive. In another research 98 countries were analysed and it was found that if measures of intellectual property protection are modified by taking into account general property rights, then there is stronger evidence for a positive relationship between intellectual property rights and economic growth (Zhang et al., 2014).

Scientific literature aims to define which type of intellectual property increases the competitiveness of innovative SMEs. The main factors affecting intellectual property and market strategies of biotech SMEs cannot be distinguished easily and are not investigated in the existing research. According to the SME case analysis in Estonia intellectual property reward regime has to be flexible and based on contractual arrangements rather than on rigid imperative legal norms (Mets, Kelli, 2013).

Patenting may be one of the most popular ways to protect intellectual property, because patent protection are strong rights and if used properly it may increase business growth. But Suzuki (2015) analysed the effects on growth of patent protection and found out that strengthening patent protection decreases the amount of common knowledge as competitors cannot freely use technological information, also, lesser disclosure of information reduces R&D productivity. Patenting activity depends on the quality of intellectual property rights protection within a country, because it promotes new R&D, only if costs on previous R&D may be recovered. In developing countries, fewer firms care about patents due to lower protection and high costs, when in developed countries higher quality protection is appreciated and firms are patenting much more (Khoury et al, 2014).

United States state of Arizona and Lithuania were selected for a case analysis based on research grant terms. These two regions have different approach and strategies of intellectual property protection and employment in business. Firms in the United States traditionally pay a lot of attention to intellectual property business value. Foreign countries that try to implement intellectual property protection systems, especially those with strong imitative ability, may attract more international business from the USA and other developed countries, and therefore may have higher business value (Awokuse, Gu, 2015). Compared to the USA, many European countries are often characterised by more technocratic and less business value focussed with respect to intellectual property rights, while the United States emerges as a key and aggressive promoter of stronger and higher global intellectual property protection standards and business value, whether multilaterally, bilaterally or unilaterally (Muzaka, 2012).

According to existing studies, in the large US firms intellectual property accounts for much of their market value: in 2009, intellectual capital—patents, copyrights, databases, brands, and organizational knowledge held a 44 percent share of US firms' overall market value (Hunter, 2016). With the conditions of ever-increasing capability in additive manufacturing, scanning, and reverse-engineering, intellectual property issues will only become more prevalent, so the current patent system should address to the digital formats of next-generation design and manufacturing systems, it is recommended to act more promptly to ensure that the data associated with digital products is protected (Kurfess, Cass, 2014). The challenge is also to increase business conversion of intellectual property. Firms experience financial losses because of intellectual property protection failures and lack of intellectual property conversion in business: domestic sales displaced by imports of infringing goods, revenue losses from fees or royalties not paid, reduced profit margins, damage to reputation or trade name, increased product liability costs, foreign piracy (Jain, 1996). In previous studies data on intellectual property protection in US multinationals firms during the period 1977–2004 were analysed and it was found out that stronger intellectual property protection is not important in determining overseas research and development by these multinational firms (Kanwar, 2012). Seemingly business value is much more important than just legal protection.

Situation of intellectual property in Lithuania may be described as legally perfect, but flawed from a business perspective. Article 23(1) of the Constitution of the Republic of Lithuania has extended protection to property and, as the Constitutional Court of the Republic of Lithuania has noted, that the constitutional protection of property covers not only the protection of tangible, but also of intellectual property (Mizaras, 2012). Intellectual property protection was extensively legislated and strengthened over three decades in Lithuania, however business use and appreciation of intellectual property is still lackluster.

3. Business value of intellectual property in Lithuanian Biotech SMEs

Biotechnology firms in Lithuania usually select patenting in order to protect their intellectual property. The situation of Lithuanian intellectual property protection is defined by strict following of the general rules of the European and international patent law. Any invention is patentable if it is new, corresponds to an inventive level and is capable of industrial application. For the legal protection of biotechnological inventions there are special rules in the Lithuanian patent law, which state, that legal protection of biological material specific characteristics should be extended to any of the same or a different form of biological material that has the same characteristics received from the first substance. Special attention to biotechnology sector is also paid by European Union by introducing special rules for legal protection of biotechnological inventions. Biotechnology is also recognizes as a priority business area in the European Union and Lithuania. This highlights that biotechnology are playing an increasingly important role in a broad range of industries and the protection of biotechnological inventions is fundamental.

Lithuanian biotech firms also have a possibility to apply for the European patent and expand it to Lithuania. The main reasons for selecting European patent are international nature, avoidance of different regulators in different national systems, procedures simplification. Unified system is especially important in the area of biotechnology inventions in order to apply for patents on them internationally. The downsides are very high costs, lack of automatic validity and significant differences from the United States – the European Patent is not very useful for gaining protection in the United States.

In Lithuania there are more than 20 biotechnology firms. Some of them were established back in the late eighties, while others are set up recently and is still young and growing firms. During the EU financial period for the year 2014-2020, Lithuanian health technology and biotechnology sector will be supported by one third of the EU investments from the Smart Specialization Strategy funding administered by the Ministry of Economy. In addition, venture capital funds is now being developed, that will be available to biotechnology firms. In 2016 years in Vilnius three new biotech business incubators are going to be opened. In following table the brief summary of 12 most well known biotechnology firms operating in Lithuania is provided focussing on their technology area, their intellectual property, financial indicators. All firms' existing national patents were investigated in the patent database of the State Patent Bureau of Lithuania (Table 1).

Table 1. Data of biotechnology firms in Lithuania

Firm name, founding years	Product/service	Number of employees in 2015	Generated income in 2015	IP strategy
"Profarma" Ltd, registered in 2007	Biosimilars and innovative drug products in the ophthalmology, oncology/ hematology and gynecology areas.	21	100-200 thousand EUR	Patenting: 3 patents.
"Baltymas", Ltd., established in 2011	Develops superior yeast expression systems and employs them for the synthesis of improved recombinant proteins.	8	30-50 thousand EUR	Patenting: one patent pending
"Sicor-Biotech", Ltd., operating since 1999	Manufacture of medicines.	214	More than 100 million EUR	Patenting: one patent application, "priority" application was filed

				in 2006 to the United Kingdom Intellectual Property Office.
JSC “Biocentras”, founded in 1988.	New biological products and technologies.	38	1-2 million EUR	Patenting: 4 Lithuanian patents and one PCT application.
“Biotechpharma” Ltd., registered in 2004	Production and manufacturing of drugs.	125	10-20 million EUR	Patenting: 2 Lithuanian patents in force, 1 international and 1 European patent application.
“Valentis” Ltd., Established in 2003	Formulate, produce and actively market innovative pharmaceutical preparations.	109	10-20 million EUR	Over 70 trade marks registered in Lithuania.
“ProBioSanus” Ltd., registered in 2012	Production line of cleaning products, which use probiotics	12	200-300 thousand EUR	4 registered trademarks in Lithuania.
“Bioeksma” Ltd., Established in 2005	Implements complex solutions of laboratory equipment in medical diagnostics.	22	5-10 million EUR	Patenting: patented at least two inventions in the field of laser optics (currently patents are invalid), 1 European patent.
“Innovative Pharma Baltics”, Ltd., founded in 2008	Produces first developed medicinal plant products.	15	500 thousand-1 million EUR	13 registered trademarks in Lithuania.
“Froceth” JSC, registered in 2012	Providing individual therapy services, which uses the client’s own cells, and/or tissues.	10	300-500 thousand EUR	No firm’s registered intellectual property rights are found.
“Bioseka” Ltd., established in 2011	Developing antisense oligonucleotide biotechnologies and other controls of antibiotic resistance in bacteria.	4	10-20 thousand EUR	No firm’s registered intellectual property rights are found.
“Biomè” Ltd., registered in 2014	Creates innovative biomedical materials for industry.	2	About 5 thousand EUR	Registered 1 trade mark and has submitted an international patent application.

Source: authors

Data about Lithuanian biotechnology firms employment and revenue was taken from the Social Security Register of Lithuanian firms.

In order to analyse the situation of Lithuanian biotechnology firms, two hypotheses have been raised:

- H_0 – number of employees, number of patents and revenue correlate equally in Lithuanian biotechnology firms.
- H_1 - number of employees, number of patents and revenue do not correlate equally in Lithuanian biotechnology firms.

For the additional analysis of the examples of analysed Lithuanian biotechnology firms regression analysis and non-parametric correlation coefficient of the employment and revenue in the studied biotechnology firms are presented in Figure 1 and Table 2.

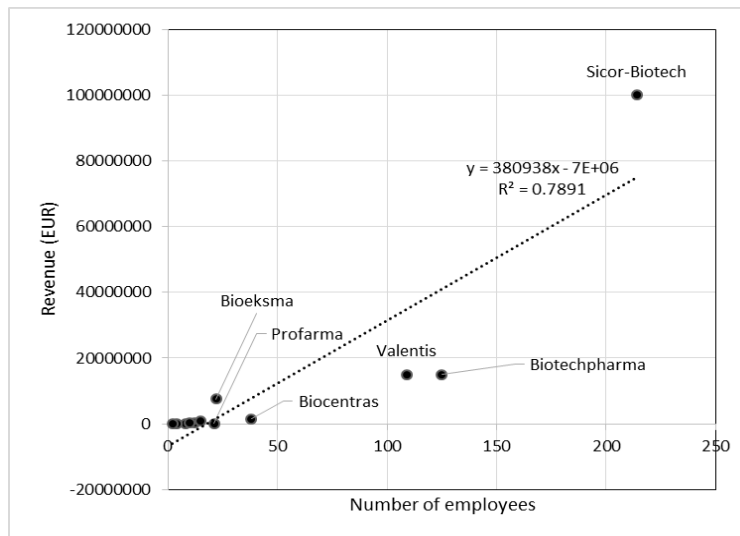


Fig.1. Regression analysis of the employment and revenue in the studied biotechnology firms in Lithuania

Source: authors.

Table 2. Non-parametric correlation coefficient for the employment and revenue in the analysed Lithuanian biotechnology firms

Symmetric Measures

	Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Ordinal by Ordinal Kendall's tau-c	.840	.099	8.521	.000
N of Valid Cases	12			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Source: authors

Regression analysis is justified since the coefficient is >0.25 . Regression analysis results shows that there is a strong correlation between employment and revenue in the Lithuanian biotechnology firms. It means that firms revenue depends on the number of employees. It may be predicted, that the more employees firm has, the more revenue it generates.

Further analysis had been done in order to understand if Lithuanian biotechnology firms' revenue correlates with number of patents held by these firms. Regression analysis is presented in Figure 2.

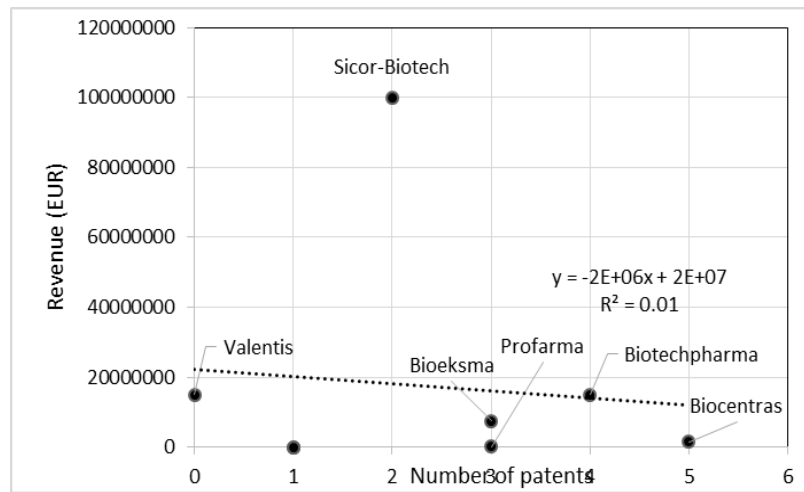


Fig.2. Regression analysis of the number of patents and revenue in the studied biotechnology firms in Lithuania

Source: authors.

Regression analysis is justified since the coefficient is >0.25 .

Regression analysis results shows that there is no correlation between number of patents and revenue. It means that firms revenue does not depend on the number of patents, which firms have.

After analysing correlations between number of employees, number of patents and revenue in Lithuanian biotechnology firms, H_1 hypothesis may be accepted, meaning that the number of employees, number of patents and revenue do not correlate equally in Lithuanian biotechnology firms. Correlations may be noticed only between number of employees and revenue, but there are no correlations between number of patents and revenue in Lithuanian biotechnology firms.

4. Business value of intellectual property in Arizona (US) Biotech SMEs

Biotechnology firms in USA were studied in the US state of Arizona.

Arizona was selected because this state is not national leader, however is ambitious in the biosciences in such fields as precision medicine, neurosciences, bioengineering, diagnostics, and agricultural biotechnology. This makes the the US state of Arizona more comparable to Lithuania, which is not a biotech leader in Europe, however has specific strenghts in certain bioscience areas.

The Arizona State has created BioMap, which lists the firms and organizations driving the biosciences in Arizona. This includes the state's firms, research institutes, educational institutions, research hospitals, and collaborating organizations. Arizona BioMap is operating as a guideline for a further development of biotechnology sector. The following table presents the main goals, strategies and actions, related to intellectual property strategies of the Arizona BioMap.

Table 3. Arizona State BioMap goals, strategies, actions

BioMap Goals	Main strategies to achieve goals	Actions, concerning intellectual property strategies
Entrepreneurial Hub	Expand bioscience firms from startups	-
	Accelerate the commercialization of discoveries and advancements	Eliminate barriers to seamless intellectual property flow between research-performing institutions and industry
	Implementation of stable and predictable tax and regulatory policies	-
Research into practice	Increase the competitiveness for R&D funds from industry, government, and philanthropy	-
	Partnerships among research-performing institutions, industry, and foundations	-
Bio-talent	Increase the supply of executive-level serial entrepreneurial talent within the bioscience industry	-
	Expand student entrepreneurship programs	Link firms with workers, and enable students to use and learn about tools, product development, intellectual property protection through expanded internship and apprenticeship programs
	Develop the talent base by attracting and retaining top graduate students, doctoral and post-doctoral candidates and trainees	-
Connectivity	Develop a strategy to form linkages of universities, private research institutes, firms, investors, and entrepreneurs in key target markets	-
	Encourage creative private-public partnerships and financing mechanisms	Educate and inform developers on space needs and requirements of the bioscience industry (including patenting)
Collaboration	Strengthen bioscience advocacy at the local, state, and national levels	-
	Remove growing impediments to collaboration	-

Source: authors.

Arizona State BioMap presents five main goals accompanied by strategies and actions. Intellectual property protection plays an important role in accelerating biotechnology sector: Arizona BioMap stresses out seamless intellectual property flow between research-performing institutions and industry, importance of learning about intellectual property protection, patenting. Mainly intellectual property protection is defined in three strategies of BioMap: Entrepreneurial Hub, Bio-talent, Connectivity.

For the case analysis 12 biotechnology firms operating in Arizona were available. The research focussed on their work practices, their intellectual property, financial indicators. All firms' revenue and employment data about was taken from America's Small Business register. The main data is briefly summarised in the following table.

Table 4. Data of biotechnology firms in Arizona State

Firm name, founding years	Product/service	Number of employees	Generated income	IP strategy
"Attometrics", registered in 2013	Uses a novel technology capable of rapidly detecting protein, metabolite and DNA analytes with unprecedented sensitivity.	3	134120 EUR	Patenting: holds 5 patents.
"HealthTell", Ltd., established in 2011	Focuses on early disease detection.	9	670601 EUR	Patenting: 3 patents

“ARBSources”, established in 2010	Focuses on wastewater treatment.	5	268240 EUR	Patenting: has filed for 3 patents, and exclusively licenses an additional 5 patents.
“Viomics”, founded in 2011.	Discovers, develops and delivers paradigm-changing cancer detection technologies to enable early and targeted intervention that cures previously deadly cancers.	3	214592 EUR	Patenting: 5 patents.
“SiO2 Nano Tech”	Uses silicon dioxide in its patented technology VitreOx to control fogging due to condensation on medical devices and athletic eyewear.	19	447067 EUR	Patenting.
“Fast PCR Diagnostics”	Has a technology that amplifies and quantifies the presence of a specific DNA/RNA sequence.	2	125179 EUR	Patenting.
“Adesto technology”	Develops conductive bridging RAM nonvolatile memory technology.	49	17882697 EUR	Patenting: in developing CBRAM technology has strong patent portfolio (9 patents). Has forging licensing agreements with SOC partners.
“Instant Bio Scan”	Developes an optical scanning machine that monitors water quality for medical, industrial, municipal and numerous other uses.	7	742132 EUR	Patenting: 4 patents.
“Desert Sweet Biofuels”, established in 2009	Produces first developed medicinal plant products.	70	894135 EUR	Patenting.
“Fertizona”, registered in 1994	Sells various liquid and dry fertilizers, agricultural chemicals, seed and other agricultural related products.	49	89413484 EUR	No firm’s registered intellectual property rights are found.
“Vitron”, established in 1991	Provide methodology for optimally preparing and incubating tissue slices	4	35765 EUR	No firm’s registered intellectual property rights are found.
“Luceome Biotechnologies”, registered in 2007	Biological Research.	4	259299 EUR	No firm’s registered intellectual property rights are found.

Source: authors.

In order to analyse the situation of Arizona biotechnology firms, two hypotheses have been raised:

- H_0 – number of employees, number of patents and revenue correlate equally in Arizona biotechnology firms.
- H_1 - number of employees, number of patents and revenue do not correlate equally in Arizona biotechnology firms.

Regression analysis and non-parametric correlation coefficient of the employment and revenue were also calculated in the studied biotechnology firms in Arizona State. The results are presented in Figure 3 and Table 5.

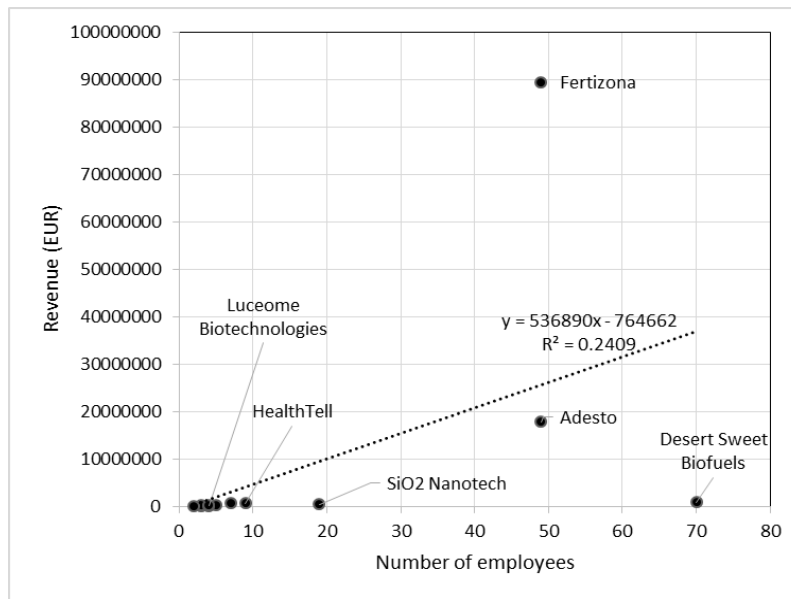


Fig.3. Regression analysis of the employment and revenue in the studied biotechnology firms in Arizona State

Source: authors.

Table 5. Non-parametric correlation coefficient for the employment and revenue in the analysed Arizona State biotechnology firms

Symmetric Measures

	Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Ordinal by Ordinal Kendall's tau-c	.734	.091	8.100	.000
N of Valid Cases	12			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Source: authors.

Regression analysis is justified since the coefficient is >0.25 , however in this case the coefficient is 0,249 and it may be concluded, that there are no correlation between number of employees and revenue of Arizona State biotechnology firms. It means that firms revenue does not depend on the number of employees. Analysed biotechnology firms may demonstrate big revenue and do not have a lot of employees. This suggests that revenue is generated by intellectual property, rather than by the employment.

Further analysis had been done in order to understand if Arizona biotechnology firms revenue correlates with number of patents of firms. Regression analysis is presented in Figure 4.

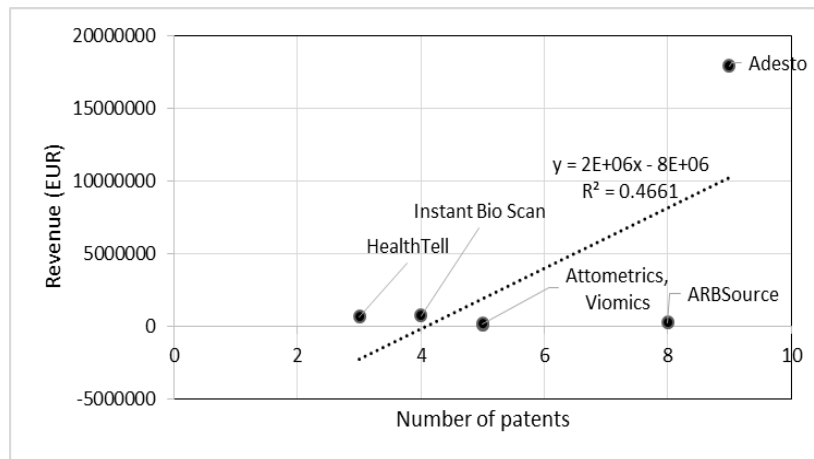


Fig.4. Regression analysis of the number of patents and revenue in the studied biotechnology firms in Arizona State

Source: authors.

Regression analysis is justified since the coefficient is >0.25 .

Regression analysis results shows that there is correlation between number of patents and revenue in Arizona State analysed firms. It means that firms revenue depends on the number of patents, which firms have. This further substantiated the former conclusion that intellectual property is the driver of business revenue in the Arizona State biotechnology firms.

After analysing correlations between number of employees, number of patents and revenue in Arizona biotechnology firms, H_1 hypothesis may be accepted. That is, number of employees, number of patents and revenue do not correlate equally in Arizona biotechnology firms. Correlations may be noticed only between number of patents and revenue, but there are no correlations between number of employees and revenue in Arizona biotechnology firms.

Conclusions

Business value of intellectual property differs across countries. United States has high global intellectual property protection standards and strong focus on the commercial purpose of intellectual property – to generate business value. Many European countries are often defined as having technocratic legal approach to intellectual property rights, when business value of intellectual property is not appreciated. As a result of this, less innovative intellectual property rights seem to be more popular in such countries as Lithuania.

Biotechnology industry is a priority industry in Europe and the US. In Lithuania there are more than 20 biotechnology firms and growing biotechnology contribution to the economy. The US is the global leader in biotechnology.

The analysis of the paper focused on empirical study of Lithuanian and the US State of Arizona biotechnology firms. Twelve firms were selected for analysis in Lithuania. For the analysis of USA biotechnology industry Arizona State was selected because this state is not a national leader, but is very ambitious in the specific biosciences. The same may be said about Lithuania. Twelve Arizona biotechnology firms were selected for closer analysis.

After comparing results of empirical study of Lithuania and Arizona State biotechnology firms the main conclusions are that Arizona biotechnology firms especially capitalize on patents and generate their revenue from intellectual property, even if the number of employees is small, while in Lithuania biotechnology firms appear not to be able to extract revenue from their intellectual property. Employee labor seems to be the source of revenue in the Lithuanian biotechnology firms, based on the results of the analysis.

The employment and revenue profile and correlations of the selected biotechnology firms in Lithuania and Arizona State showed big differences: in Lithuania firms revenue depends on the number of employees and it may be predicted, that the more employees firm has, the more revenue it generates, while in Arizona State revenue does not depend on the number of employees and firm may have a huge revenue despite the small number of employees. Further analysis showed that there are no correlations between number of patents and revenue in Lithuanian biotechnology firms, but there is a correlation between number of patents and revenue in Arizona biotechnology firms.

Further research with larger data samples may be needed to fully validate these findings, however the analysis clearly enough demonstrates the differences of revenue, employment and intellectual property profile in Lithuania and Arizona State. This suggests that Lithuanian biotechnology firms need to develop an intellectual property commercialization strategy and need to focus on converting intellectual property into revenue in their target markets, rather than just trying to patent their technology somewhere.

These findings are applicable not only to Lithuania, but also for other smaller European Union countries, which have ambitions to develop biotechnology science and business.

*The article is published under the research, which is funded by Lithuanian Research Council under the measure „Support to Researcher Teams' Projects” (grant No. MIP-14446, name of the project “Research of Biotechnology SME's Intellectual Property Strategies”).

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Mindaugas KIŠKIS is the Professor at Mykolas Romeris University in Vilnius, Lithuania. Prof. M. Kiskis main areas of research and expertise are – intellectual property, technology (bio-nano-ICT) management, regulation and policy; digital content and digital media, privacy and data protection issues. Prof. Kiskis also works in e-business, innovation and entrepreneurship fields. Prof. Kiskis is a fellowships recipient with major foreign universities, including Visiting Professor at the East China University of Science and Technology (2013), Understanding Canada Scholar (2011), Fulbright Scholar at the Arizona State University (2007-2008), Markle Fellow at the Oxford University (2003) and other. Prof. M. Kiskis is also the serial entrepreneur, cofounder of three technology start-ups, active member of the knowledge society NGOs, also, the author of 4 monographs, 4 textbooks and 35 articles in Lithuanian and foreign publications.
ORDCHID ID: orcid.org/0000-0003-4269-375X

Tadas LIMBA is Assoc. prof. at Mykolas Romeris University, Lithuania. He has published over 20 articles in Lithuanian and foreign scientific journals, monograph, textbook, focused on e-government and e-business. His additional areas of research and expertise are – IT law regulation and policy; digital content, digital media, privacy and data protection issues. Tadas Limba is a member of Lithuanian Computer Society since 2007. Since 2013 he is Asia Center Board Member, South Korea's representative at Mykolas Romeris University. He is visiting professor at Zaragoza University in Spain. He plays an active role in international communication and development of joint double degree studies program with South Korea Dongseo University.
ORDCHID ID: orcid.org/0000-0003-2330-8684

Gintarė GULEVIČIŪTĖ is a PhD student (in Management) and lecturer at Mykolas Romeris University, Lithuania. Her areas of interest are e-business, e-marketing, entrepreneurship, business communication and digital contents. She plays an active role in international communication and development of joint double degree study programs with South Korea Dongseo University.
ORDCHID ID: orcid.org/0000-0003-1974-3982