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INSIGHTS INTO REGIONAL DEVELOPMENT*

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FOREWORD to
INSIGHTS INTO REGIONAL DEVELOPMENT
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2020 Volume 2, Number 2 (June)

Dear readers,

Attention to regional development cannot be overestimated. When one region encounters development problems, the consequences will spill over eventually and affect other regions. It is obvious, that globalization phenomenon besides its positive outcomes, has its negative outcomes. Therefore, there is need to monitor and evaluate critically on a permanent basis a wide range of processes, which emerge in various countries.

International attempts of scientists, practitioners, politicians, NGOs to immerse into issues of regional development have to be supported in all possible ways.

Insights into Regional Development journal serves as international hub of ideas exchange. It is supported by European Commission through Horizon 2020 funding. Let us care about local issues for global wellbeing.

With my respectful greetings,

A handwritten signature in dark ink, appearing to read 'Alminas Mačiulis'. The signature is stylized with a long, sweeping horizontal stroke at the end.

Dr. Alminas MAČIULIS
Deputy Chancellor of The
Government of the Republic of Lithuania



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DETERMINANTS OF FINANCIAL DEVELOPMENT OF THE EU COUNTRIES IN THE PERIOD 1995-2017*

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Abstract. The aim of the research is to determine the impact of openness and political stability which characterize the state of political rights and civil liberties; financial state regulation; the determinant of legal traditions which determines judicial independence, impartiality of the courts, protection of property rights, etc., the determinant of financial institutions, as well as the impact of certain macroeconomic indicators on the financial development of the EU countries in the period 1995 – 2017.

Keywords: financial development; EU; determinants of financial development

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1. Introduction

There is a large number of factors which influence financial development; and specialized literature considers various approaches to the systematization of these factors (Voghouei et al. 2011).

Determinant of openness. It has been determined that a significant growth in international trade and capital flows have a positive effect on financial development (Zingales 2003). Huang and Temple (Huang 2005, Huang & Temple 2005) found that the increase in the level of market openness leads to the increase in financial depth. Moreover, countries with more advanced financial systems are more likely to increase exports of manufactured goods in GDP, and to increase exports of goods. Easing restrictions on international flows affects the liquidity of stock markets, which allows a larger number of foreign banks to operate (Levine 2005), and has a positive impact on the performance of the domestic banking system.

Determinant of financial liberalization. Financial liberalization can be considered as the sum of the following components: privatization of public financial institutions and banks, a guarantee for a free entry into the financial sector and independence of the Central Bank, abolition of tools for monetary control and introduction of free tools for interest rate control (Arestis, 2005; Arestis and Demetriades 1997; Arestis et al. 2002; Caplinska and Ohotina, 2019). Liberalization of financial markets leads to better allocation of resources, and higher levels and efficiency of investment.

Other authors believe that financial development is affected by the prevailing form of ownership of credit institutions, as well as the features of the prevailing model of corporate ownership and management of financial institutions (Novickytė and Pedroja 2014). It is more convenient to consider these factors from the viewpoint of the analysis of their configuration that determines the restriction of financial development and growth of economy (Čižo et al. 2018). Low banking capitalization and a low level of corporate management in banks were important features in the countries that had experienced financial liberalization. “Undercapitalized” banks have incentives to take on excessive risks, especially if additional “guarantees” of security (for example, a system of deposit insurance) have been introduced into the banking system. This phenomenon can be interpreted as a “defect” of the financial market. Minimization of its impact is associated with the establishment of an effective system of financial regulation and supervision. It should include strict requirements to maintenance of the amount of equity, increase in the transparency of banks’ risk management systems, and disclosure of information about the relative exposure to large risks. It is possible to achieve the establishment of a better mechanism for financial intermediation via improving the corporate model, which implies a transition to the market control over banks’ actions, and to the control by the stock market. In this case, it is really possible to connect the establishment of an effective system of bank’s risk management with a system that allows “fining” bank shareholders who take excessive risk. This would entail the enhancement of market discipline of bank managers and could create conditions for sustainable growth.

Determinant of legal traditions. L’opez de Silanes (L’opez de Silanes et al. 1998) emphasizes the significance of a legal system for ensuring the protection of property rights. The relationship between the system of law and the degree of development of capital markets has been established in the works by La Porta, L’opez de Silanes et al., etc. Countries of the French branch of civil law (continental branch) have less developed capital markets, compared to the countries belonging to the Common Law system (the English branch). However, there are not any significant differences between groups of countries in respect of the development of the banking sector. Having studied legal rules and practice of rights protection of minority shareholders and creditors, the authors determined that the countries of the Common Law system create stronger protection for shareholders. Within the group of the code law, countries of the French civil law provide the worst legal protection for shareholders and creditors. The legal origin has a significant impact on the law enforcement practice. Countries of the Common Law system and Scandinavian countries of civil law have a better quality of the law enforcement practice, while

countries of the French civil law have the worst one. An interim conclusion drawn from these studies is that countries with a continental model of law, which presumably provide less legal protection to minority shareholders and creditors, have less developed capital markets and a greater concentration of ownership at the level of industries and firms. However, the importance of belonging to a particular legal tradition turned out to be less pronounced for the development of the banking system.

In addition, as Zingales (Zingales 2003) mentioned, countries with the legal system based on the French civil code in 1913 and 1929 were at the same level of development as the Common Law countries. Their lagging behind started only after World War II. This could be a possible indication against the decisive influence of the factor of belonging to a certain legal tradition. Moreover, as Zingales showed, it is closely related to a set of historical, cultural, socio-economic, and political-economic factors. Therefore, it is extremely difficult to determine the priority and distinguish any of them.

Determinant which characterizes institutions. There is a large number of interpretations of the concept “institution”. North, D.C (North and Thomas 1973; North 1990) provided the following definition of institutions: “Institutions are the rules of the game of a society or more formally are the humanly devised constraints that structure human interaction”. Hodgson (Hodgson 2006) believes that “institutions are the systems of established and prevalent social rules that structure social interaction”. He states that organizations are specialized institutions. Dixit and Greif (Dixit 2004; Greif 2000) define institutions as “a system of social factors – rules, beliefs, norms, and organizations that guide, determine, and constrain human actions”. This definition also included the concepts of an organization and institutions, presenting the organization as an example of institutions.

Institutions can be classified into two groups:

1. Formal or “strict” (public) institutions - universal and transferable (to other people) rules that include the Constitution, laws, statutes, regulations, and norms, as well as their elements such as the rule of law and property rights, strict compliance with the terms of the contract and the independence of regulatory systems (Amin 1999).
2. Informal or “soft” institutions – they form the social capital of society and include a number of features of life in a certain society, such as norms, traditions, social conventions, interpersonal contacts, relationships, and informal groups, which are an important element for the formation of trust within society.

Acemoglu, Johnson и Robinson (Acemoglu et al. 2005; Acemoglu et al. 2001; Acemoglu et al. 2002; Acemoglu et al. 2003; Acemoglu et al. 2005; Acemoglu and Robinson 2006) studied formal institutions in more detail and presented the following interrelated classification:

1. Economic institutions. This group includes factors that determine the structure of incentives in society (i.e. incentives for economic agents to invest, accumulate production factors, make transactions, etc.) and ensure the redistribution of resources in the economy. For example, the structure of property rights, barriers to business, types of contracts formalized in legal documents, and tax transfer redistribution schemes.
2. Political power and political institutions. Economic institutions are the result of the collective choice of society. Society is made up of different groups with often opposite interests. The relative political power of these groups determines their ability to manage resources and implement economic policies. The distribution of political power determines the structure and quality of economic institutions. This, in turn, is a consequence of political power, i.e. the power which arises from economic results. Political institutions include institutions which delegate political power between various groups. They are related to the characteristics of the government and current constitution.

Voghouei (Voghouei et al. 2011) noted that political choice determines the forces of influence on the development and functioning of the financial system. Beck (Beck et al. 2001) highlights that a financial system in the country under centralized, authoritarian, and closed political regime is likely to be less developed than in the country with democracy and an open, highly competitive government that is controlled by law. Political and

economic factors directly affect financial development and have an indirect influence on other determinants of financial development. For example, an economic institution is one of the key factors of financial development. This factor is endogenous and it is determined by political institutions. Acemoglu (Acemoglu et al. 2005) claimed that different economic institutions lead to different distribution of resources. Siegle, Weinstein and Halperin (Siegle et al. 2004) suggest that democracy can be seen as a source for development. The authors believe that democratic systems are “always stronger” than authoritarian regimes; democracy and political freedom can promote financial development, as they support the establishment of such important institutions as mechanisms for checks and balances, a system of self-monitoring and restrictions based on regulations.

Voghouei (Voghouei et al. 2011) identified that political factors both directly affect financial development and play an important role in the formation of institutional openness.

Governments can pursue national economic goals, as well as narrow political interests by controlling banks' decisions regarding credit support for enterprises. This factor and a number of other factors prove that the privatization of banks can improve the efficiency of credit allocation and, therefore, have a positive effect on the quality and volume of investments. La Porta, Lopez-de Silanes, and Shleifer in their work provided the assessment of the impact of bank privatization on the economic growth (La Porta et al. 2002). They discovered that government ownership of banks is negatively correlated with both financial development and growth. At the same time, a 10% decrease in the share of bank assets owned by the government is related to 0.25% increase in growth per year. In addition, they show that it is impossible to achieve a positive effect of growth if the privatization of banks happens without elimination of institutional defects (a weak protection of property rights and low government efficiency).

Governments do not always demonstrate their willingness to use the potential resource of financial development. A political and economic factor can explain a phenomenon of uneven financial development, i.e. the existence and power of a pressure group which either supports or opposes the idea of financial openness and financial development. The history of the 20th century demonstrate that financial development can be neither provided nor be a success if the ruling elite opposes it (Načisčionis et al. 2018.). Poor development of financial markets creates an environment for officials from large and well-known industrial or financial companies to benefit from monopolistic nature of rents. Companies' market power under a poor disclosure system and weak contracts imposes high entry barriers for new potential agents. Therefore, the management of such companies (having a strong influence in the government) often opposes financial openness and financial development.

Development level of the standards of financial reporting. The impact of accounting standards (Subačienė et al. 2018; Nadhir and Wardhani 2019), a bankruptcy system, and management standards and procedures on the growth and development of the financial sector was investigated by Levine and Beck, and others (Beck 2002; Beck et al. 2001; Levine 2005; Puryaev, Puryaev, 2019).

The authors found that countries with better accounting information, with an appropriate level of protection of investors' and creditors' rights, tend to have more intense development of financial intermediation. This way, the growth prospects are enhanced by the fact that the legal environment, formal and informal rules and procedures that structure the information environment and regulate the behaviour of corporate participants and investors, acting together, encourage the development of financial intermediation. Mechanisms for formation of changes and transfer of impulses to the economy provided by the financial sector, as well as the nature of the factors that determine the development of the financial sector are still relevant topics for research.

In addition to Acemoglu's classification, Rodrik (Acemoglu et al. 2001; Acemoglu et al. 2002; Acemoglu et al. 2003; Acemoglu et al. 2005; Acemoglu and Robinson 2006; Rodrik 2005) studied economic institutions in more detail dividing them into the following groups:

1. Institutions of market formation – institutions of judicial, legislative, and administrative state system which ensure property rights and execution of contracts. Guarantees for property rights and execution of contracts affect incentives for economic activity, contribute to increased productivity and resource efficiency. The incentive structure of economy becomes significantly limited without these institutions.

2. Institutions of market stabilization – institutions of monetary circulation and tax regulation, prudential regulation and supervision, institutions of risk coordination and sharing (for example, a banking and credit system, tax authorities, stock market, pension funds, private and state venture companies, and agencies).

Countries need monetary, fiscal and other measures to combat economic cycles (Katan et al. 2019). Ensuring complex security of the financial flows movement in the national economy system, Journal of Security and Sustainability Issues 9(1): 39-50.. Therefore, the effectiveness of market stabilization institutions provides for consolidation of financial resources, helps to coordinate the work of small and medium-sized investors, allows more efficient allocation of resources in the economy, enables to reduce transaction costs, and to support the innovation process and successful emergence of new sectors in the economy.

3. Institutions of market regulation – regulatory government bodies that provide control and monitoring of various aspects of enterprises' daily activities (opening, expansion, and liquidation of business; access to infrastructure, and land; issue of building permits; compliance with the general rules for foreign trade; licensing and certification; tax rules; sanitary and epidemiological regulations; safety regulations), and have the right to suspend enterprises' activity; institutions of antimonopoly regulation and control which ensure the quality of market competition. Market requires comprehensive rules to reduce possibilities for abusing market power, the influence of external factors, and combating information asymmetry, as well as creation of a product and security standards, etc. In general, the profitability of operations and attractiveness of private investment depend on the efficiency and impartiality of functions of market regulation institutions.

4. Institutions of market legitimization – institutions of human capital development (institutions in the sectors of healthcare, education, social security and insurance).

Institutions provide for appropriate environment for creativity, innovations, and protection of intellectual rights. In addition, they increase competition for potential opportunities (resources), at least as long as the rule of law applies to all members of society without exception. Developed institutions provide for protection of property rights; they also promote full consistency with contracts, integration into the global economy, and support for macroeconomic stability; they help manage financial intermediaries' risks, and provide for social insurance and social protection, as well as hold government accountable. These factors create incentives for economic agents to conclude and implement a larger number of long-term contracts, which eventually contributes to the increase in investment and sustainable economic growth. The quality of institutions has a positive impact on such components of the country's economic development as functions of its financial system, development of entrepreneurship, and inflow of foreign direct investment (FDI).

Macroeconomic determinants. Inflation, investments, and economic growth influence financial development. Huybens and Smith (Huybens & Smith 1999) determined that inflation has a negative impact on financial development. The higher the level of inflation is, the lower the real return on money is, which results in decrease in lending. If the financial sector provides less credit, it means that the distribution of money is inefficient, and has a negative effect on financial development. Levine (Levine 2005) found that the gross national income per capita and the savings rate are positively linked to financial development.

Culture and geography. Stulz and Williamson (Stulz & Williamson 2003) identified the influence of cultural differences such as differences in language and religion on the level of financial development. The study confirmed that culture might be the factor that explains differences between countries regarding protection of investors' rights and provision of compliance with contracts, in particular depending on the rights of creditors.

2. Design and the sample of the research

In the research, financial development is reflected by the indicators of financial development (Rethinking Financial Deepening: Stability and Growth in Emerging Markets) in the EU countries available in the period 1995 - 2017. The indicator of financial development has the following structure (Figure 1):

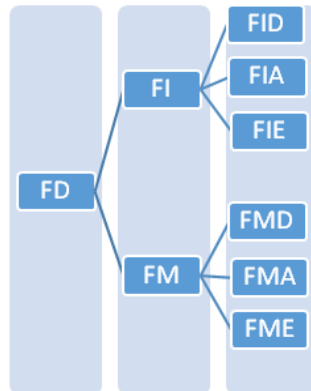


Fig. 1. Structure of financial development indicator

Source: Rethinking Financial Deepening: Stability and Growth in Emerging Markets. Imfstaffdiscussion note 2015.

<https://www.imf.org/external/pubs/ft/sdn/2015/sdn1508.pdf>

Note: FD – financial development; FI – financial institutions; FM – financial markets;

FID - financial institutions depth; FIA - financial institutions access; FIE - financial institutions efficiency; FMD - financial markets depth; FMA - financial markets access; FME - financial markets efficiency.

FID - financial institutions depth is characterized by the following indicators: private-sector credit (% of GDP), pension fund assets (% of GDP), mutual fund assets (% of GDP), insurance premiums, life and non-life (% of GDP).

FIA - financial institutions access is characterized by the following indicators: branches (commercial banks) per 100,000 adults; ATMs per 100,000 adults.

FIE - financial institutions efficiency is characterized by the following indicators: net interest margin; lending-deposits spread; non-interest income to total income; overhead costs to total assets; return on assets; return on equity.

FMD - financial markets depth is characterized by the following indicators: stock market capitalization to GDP; stocks traded to GDP; international debt securities government (% of GDP); total debt securities of nonfinancial corporations (% of GDP); total debt securities of financial corporations (% of GDP).

FMA - financial markets access is characterized by the following indicators: percent of market capitalization outside of top 10 largest companies; total number of issuers of debt (domestic and external, nonfinancial corporations, and financial corporations).

FME - financial markets efficiency is characterized by the following indicator: stock market turnover ratio (stocks traded/capitalization).

Each indicator is standardized from 0 to 1. The lowest value of the indicator for countries is zero, and all other values are measured regarding this minimum value. In order to avoid the pitfalls appearing as a result of extreme data, the values of variables of the 5th and 95th percentile are defined as cut-off levels. Indicators are defined in a such way that higher values indicate better financial development. Then, the indicators are grouped into six sub-indices in the lower part of the pyramid (see Fig. above). The aggregation is a weighted average of the base series, where the weights are the squares of the factor loadings from the analysis of principal components, in such a way that their sum comprises 1. Finally, sub-indices are similarly aggregated into higher indices using the factor analysis according to the method of principal components; the FD index is aggregated in a similar way.

The table 1 below presents indicators which characterize determinants of financial development

Table 1. Determinants of financial development: empirical interpretation of indexes

Index	What the index refers to	Source
Freedom to Trade Internationally as a subsystem of Economic Freedom index	Determinant of openness	Fraser Institute
Political Stability index as a subsystem of the Economic Freedom index	Determinant which characterizes institutions: Political power and political institutions	The Freedom in the World Survey
Economic Freedom index Government Regulation index: regulation of business, labour, and credit as a subsystem of Economic Freedom index	Determinant of financial liberalization	Fraser Institute
Legal System and Property Rights	Determinant of legal tradition	Fraser Institute
Sub-indices of Economic Freedom index: freedom of business; freedom of money; freedom of investment; financial freedom, freedom of labour.	Determinant which characterizes institutions: Economic institutions	Heritage Foundation
Inflation Investment Human capital	Macroeconomic determinants	Eurostat
Primary religion	Culture and geography	CIA World Factbook

Source: developed by the authors on the basis of the following sources:

Voghouei et al. 2011, La Porta et al. 2002, Acemoglu et al. 2001, Acemoglu, et al. 2002, Acemoglu et al. 2003, Acemoglu et al. 2005, Acemoglu and Robinson 2006, Rodrik, 2005, Huybens & Smith 1999, Levine 2005, Stulz, R. M. & R. Williamson (2003).

In order to identify the impact of the abovementioned determinants on the financial development of the EU countries in the period 1995-2017, the authors use a correlation analysis; the strength of relationship is characterized by the value of the Pearson correlation coefficient.

3. Research results

In order to calculate the impact of financial liberalization on financial development, the Economic Freedom of the World index (Economic Freedom in the World 2019) published by Fraser Institute in Canada (Fraser Institute) was applied. The integral index consists of sub-indices: Size of Government (a level of state regulation) (EF1), Legal System and Property Rights (EF2), Sound Money (EF3), Freedom to Trade Internationally (EF4), and Regulation (EF5). These 5 areas are divided into 24 components, which in turn also consist of several indicators. In general, 42 variables are used to calculate the index. Their average value determines the level of each component. The assessment of the area is calculated as the average value of all components.

Having calculated correlation coefficients of the Economic Freedom index and the Financial Development index, it is determined that there is a linear dependence; from 1995 until 2000 it was very strong and positive; later, until 2005 the linear dependence was average and positive; after 2005, values of the correlation coefficients decreased gradually, and since 2012, the linear dependence became very weak and positive; in 2017 it became close to 0 (Figure 2).

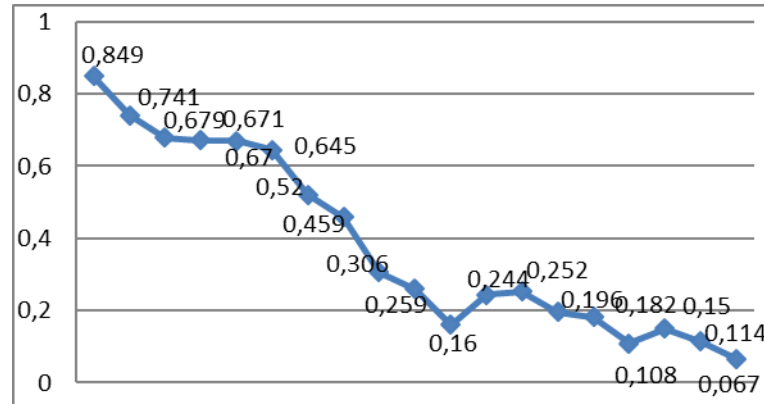


Fig. 2. Pearson correlation coefficients which characterize the linear dependence of the Financial Development index on the Economic Freedom index (p-value<0.01).

Source: the authors' calculations on the data from Rethinking Financial Deepening

In the period 1995 – 2017 the impact of the Economic Freedom index which characterizes financial liberalization gradually decreased from being strong to being very weak.

Size of Government index consists of 4 components: government consumption, transfers and subsidies, government enterprises and investment, top marginal tax rate, and top marginal income tax rate. The index shows to what extent countries rely on a political process when distributing resources, goods, and services. When government spending increases as compared to that of individuals, households, and enterprises, political decision-making replaces personal choice. Government consumption as a share of total consumption, and transfers and subsidies as a share of the GDP are the indicators of the size of government. When government consumption comprises a larger share of the total volume, political choice is replaced with personal choice. Similarly, when governments tax some people in order to provide transfers to others, they restrict people's freedom to keep what they earn. The third component measures the extent to which countries use private investment and enterprises rather than public investment. Governments and state-owned enterprises play by rules that are different from those of private enterprises: they do not depend on consumers and private investors, and often operate in protected markets. The fourth component reflects top marginal income tax rate and top marginal income and payroll tax rate, and the threshold at which these rates begin to apply. These two subcomponents are averaged to calculate the top marginal tax rate. High marginal tax rates, which apply at relatively low levels of income, also indicate the dependence on government. These rates deprive people of results of their work. Therefore, countries with low government spending as a share of the total volume, a smaller sector of state-owned enterprises and lower marginal tax rates have the highest ratings in this area.

There is a negative linear dependence between the values of the **Financial Development** index and the **Government Regulation** index: business regulations, labour market regulations, and credit market regulations (a subsystem of the Economic Freedom index), i.e. the larger the size of government is and the more it interferes in business, labour and credit markets, the poorer the financial development is. In 1995 the Pearson correlation coefficient comprised -0.052, after that it was gradually increasing, and by 2017 it comprised -0.482. Therefore, the influence of this factor on financial development during the period under study increases. At the same time, there is a danger that by controlling the decisions of banks regarding credit support for enterprises, government may pursue not only national economic goals, but also narrow political interests.

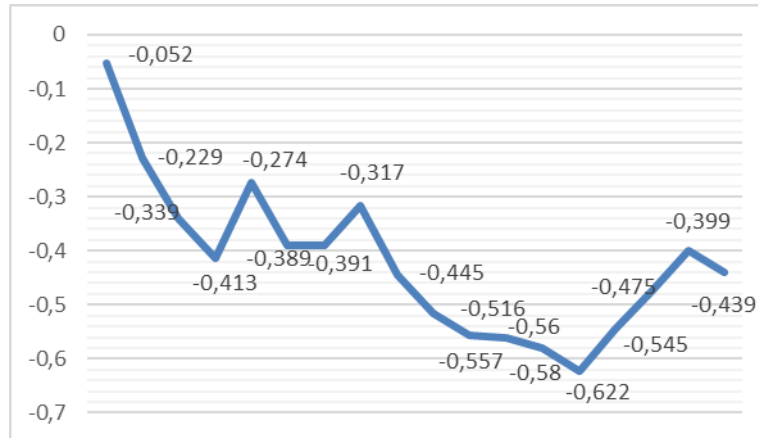


Fig. 3. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Government Regulation index: business regulations, labour market regulations, credit market regulations (p-value<0.01).

Source: the authors' calculations on the data from Rethinking Financial Deepening

There is a positive impact of the **determinant of financial liberalization** on financial development in the period under study in the EU countries, but this influence decreases sharply every year (Figure 3). However, the impact of government regulation on financial development becomes stronger. For example, J. Stiglitz (Stiglitz 2000) believed that strategies which included financial liberalization (as well as liberalization of capital market) did not take into account one important factor: capital flows are pro-cyclical, so claims that opening of capital markets encourages diversification and increases stability were incomplete. This led to the conclusion that it was necessary to review permitted ways for government intervention which could stabilize the short-term movement of capital, and, therefore, he considered government regulation to be justified.

Freedom to Trade Internationally index reflects international trade taxes (revenue from trade taxes as a share of export and import, mean tariff rate, standard deviation of tariff rates) and regulatory trade barriers (non-tariff trade barriers, compliance costs of importing and exporting), as well as actual volume of foreign trade as compared to the expected one, difference between official exchange rates and black-market exchange rates, government control on international movement of capital (foreign ownership and investment restrictions, restrictions of freedom for citizens to participate in capital operations with foreign partners – the index of monitoring capital operations according to 13 categories of International Monetary Fund).

Having examined the influence of the **determinant of openness**, expressed by the **Freedom to Trade Internationally** index on financial development, a positive linear dependence is determined. However, the value of the Pearson correlation coefficients is gradually decreasing from 0.632 in 1995 to 0.062 in 2017 (Figure 4).

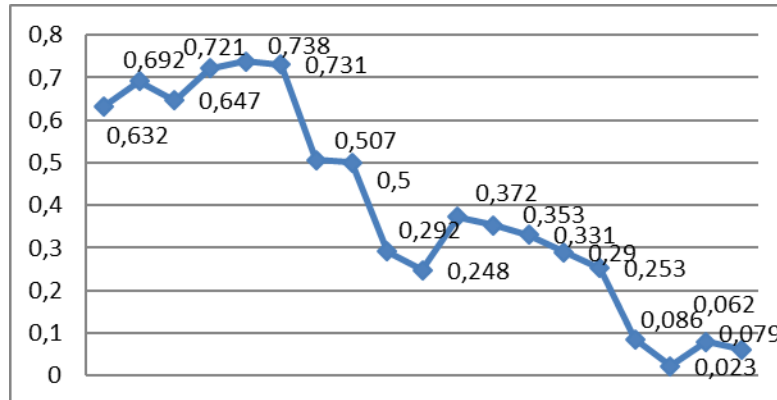


Fig. 4. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Freedom to Trade Internationally index (p-value<0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

Financial development can be neither provided nor be successful if the ruling elite opposes it. Zingales and Rajan explain that the poor development of financial markets creates an environment for officials of large and well-known industrial or financial companies to benefit from monopolistic nature of rents. Companies' market power under a poor disclosure system and weak contracts imposes high entry barriers for new potential agents. Therefore, the management of such companies (having a strong influence in the government) often opposes the openness and financial development. "Open borders decrease the opportunities for politicians to decrease the level of competition and slow down financial and economic growth" (Zingales and Rajan 2003).

Having examined the impact of the **determinant of legal traditions** expressed by the **Legal System and Property Rights** index on financial development, a positive linear dependence is determined. The Legal System and Property Rights index reflexes judicial independence, impartial courts, protection of property rights, military interference in rule of law and politics, integrity of the legal system, legal enforcement of contracts, regulatory costs of the sale of real property, reliability of police, and business costs of crime. Protection of persons and their rightfully acquired property is a central element of civil society. Values of Pearson correlation coefficients decreased insignificantly from 1995 to 2017, and comprises 0.716 and 0.562 respectively. Legal system which guarantee and provide property rights is a key basis for financial development, which was confirmed in the study conducted by L. Zingales and R. Rajan (Zingales, Rajan, 2003). See Figure 5.

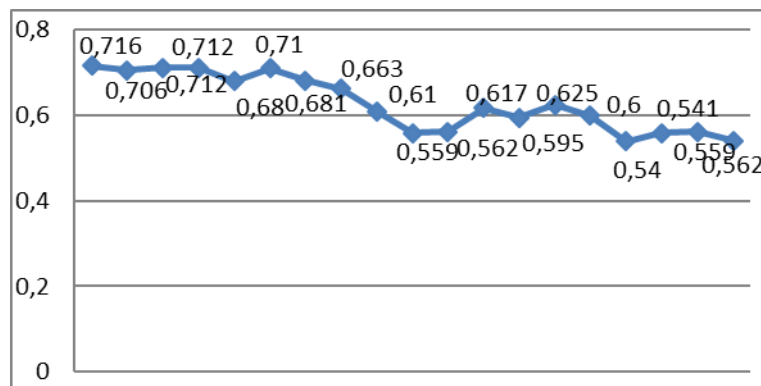


Fig. 5. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Legal System and Property Rights index (p-value<0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

The determinant characterizing **Political Power and Political Institutions** is expressed by the **Political Stability** index which represents the data of the survey on 2 areas: political rights (0-40 points) and civil liberties (0-60 points) (Freedom in the World is Freedom House's flagship annual report assessing the condition of political rights and civil liberties around the world). Free press, active public participation in political life and competitive political parties contribute to the solution of the issue on pressure imposed by influential persons who are interested in the development of only those institutions which are beneficial to them and which will support their power. However, it possible to effectively prevent the subordination of economic policy to the interests of new influential circles only in the context of foreign economic competition... which forces politicians to pursue a more effective policy aimed at the market development (Zingales and Rajan, 2003). There is a positive linear dependence between the values of the Financial Development index and Political Stability index. However, there is a trend for decline in the values of Pearson coefficients in the period 1995 – 2017. During this period, the linear dependence changed from being strong to very weak; it comprises 0.088 in 2017. See Figure 6.

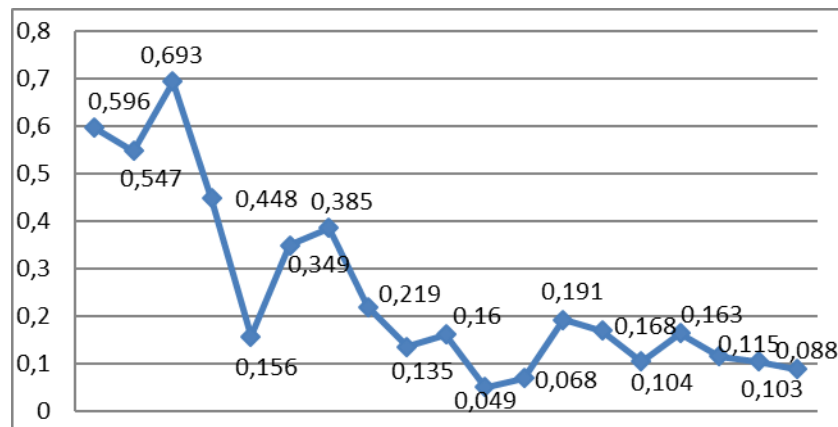


Fig. 6. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Political Stability index (p-value<0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

The determinant characterizing **Economic Institutions** includes factors which determine the structure of incentives within society (i.e. incentives for economic agents to invest, and accumulate factors of productions, to make deals, etc.) and provide the redistribution of resources in the economy. The following sub-indices of the Economic Freedom index calculated by the **Heritage Foundation** have been selected as indicators which characterize this determinant: freedom of business, freedom of investment, and financial freedom. A linear dependence of the Financial Development index on Freedom of Business index is positive and it does not have an explicitly expressed trend for changing: it ranges from 0.562 to 0.314 in the period 1995 - 2017. (See Figure 7).

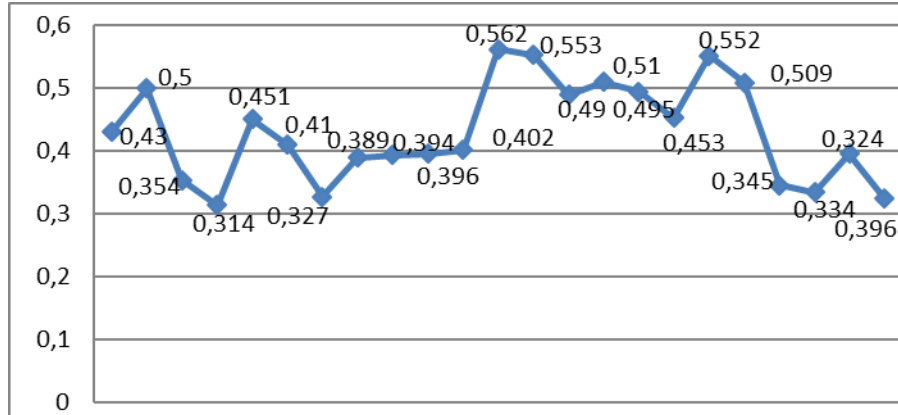


Fig. 7. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Freedom of Business index (p-value <0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

In the period 1995 – 2017, the linear dependence between the Financial Development index and Economic Freedom index is positive (except for 2006), but it becomes weaker from 0.552 to 0.236. However, during the years of economic recession, the linear dependence sharply decreases, and then increases. (See Figure 8).

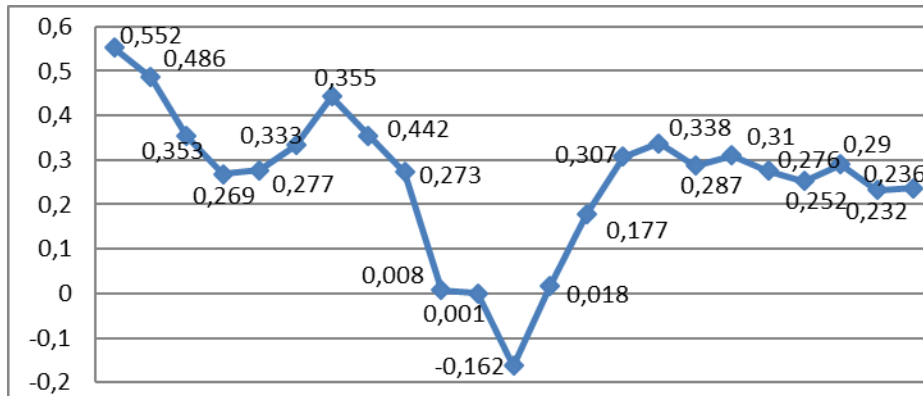


Fig. 8. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Economic Freedom index (p-value <0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

In the period 1995 – 2017, the linear dependence between the Financial Development index and Freedom of Investment index is positive. Despite some fluctuations, it tends to increase (in 1995 the value of the correlation coefficient comprised 0.216, by 2017 it increased to 0.470). (See Figure 9).

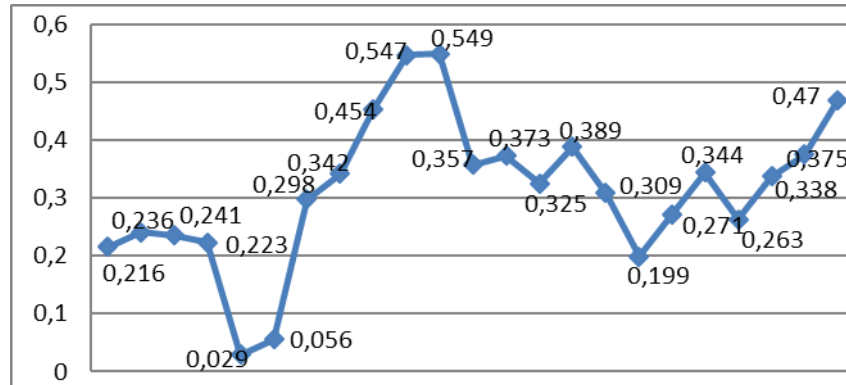


Fig. 9. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Freedom of Investment index (p-value <0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

Macroeconomic determinants: inflation, gross fixed capital formation. A linear dependence characterizes the impact of inflation on financial development. However, in the period 1995 – 2013 it was negative (the correlation coefficient ranges from -0.330 to -0.739), i.e. it had a negative impact on financial development. In the period 2014 – 2016, it was positive (the correlation coefficient ranges from 0.104 to 0.379). In 2017, it again became negative (the correlation coefficient -0.402). The higher the inflation is, the lower the return on money is, which leads to decrease in credit activities. If a financial sector provides less credit, it means that the distribution of money is inefficient, and has a negative effect on financial development (See Figure 10).

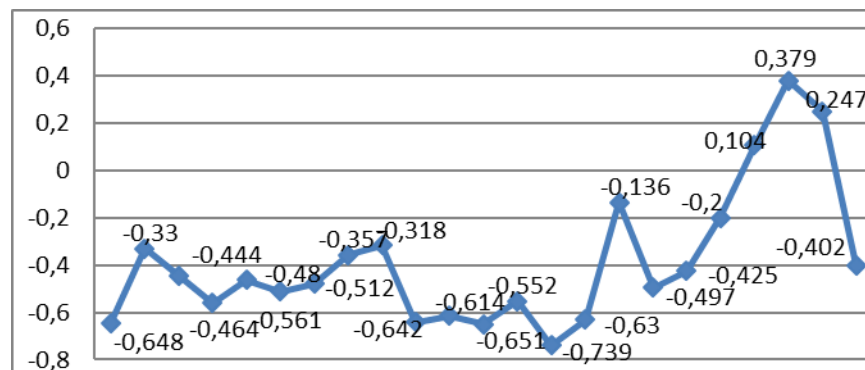


Fig. 10. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and inflation (p-value <0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

An extremely weak linear dependence characterizes the impact of investment into fixed capital on financial development in pre-recession and post-recession years. During the periods of recession and economic recovery, the linear dependence is expressed by the average value of Pearson correlation coefficients (See Figure 11).

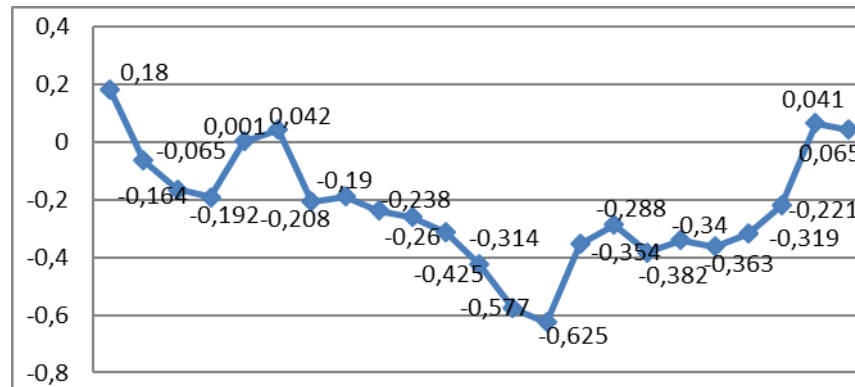


Fig. 11. Pearson correlation coefficients in the period 1995 – 2017 between the values of the Financial Development index and Gross Fixed Capital Formation (% of GDP) (p-value<0.01).

Source: the authors' calculation on the data from Rethinking Financial Deepening

Determinants of culture and geography will be not considered within the framework of the research as they do not belong to the sphere of economy.

Conclusions and discussion

In general, the correlation analysis of the impact of liberalization on financial development of the EU countries in the period 1995 – 2017 confirms the ideas by Arestis, Demetriades, Bassam and Kostas (Arestis 2005; Arestis and Demetriades 1997; Arestis et al. 2002) that liberalization of financial markets leads to better redistribution of resources, a higher level of investment and higher efficiency of investment, and, therefore, has a positive impact on financial development. However, this influence weakened by the end of the period under study.

The ideas by Zingales (Zingales 2003), Huang and Temple (Huang 2005, Huang & Temple 2005) about the impact of openness on financial development were also confirmed on the sample of the EU countries in the period 1995 – 2017: having examined the impact of the determinant of openness which is expressed by the Freedom to Trade Internationally index, a positive linear dependence was determined. However, the dependence significantly weakened by the end of the period under study.

The idea by La Porta, L'opez de Silanes (L'opez de Silanes et al. 1998) about the relations between the legal system and the degree of market development is confirmed: having examined the impact of the determinant of legal traditions expressed by the Legal System and Property Rights index on financial development, a strong positive linear dependence was determined during the whole period 1995 - 2017.

The ideas by Voghouei (Voghouei et al. 2011), Zingales L., Rajan R. (Zingales and Rajan 2003) about the impact of political factors on financial development were confirmed: there is a positive linear dependence between the values of the financial development index and political stability index. However, the values of Pearson coefficients have a tendency to decrease in the period 1995 – 2017. During this period, the linear dependence changes from being strong to being very weak: in 2007 the correlation coefficient comprised only 0.088.

Acemoglu's ideas (Acemoglu et al. 2005) about such a key factor of financial development as economic institutions were confirmed. The determinant characterizing economic institutions includes factors that determine the structure of incentives within society (i.e. incentives for economic agents to invest, and accumulate factors of productions, to make deals, etc.) and provide the redistribution of resources in the economy. The linear dependence of Financial Development index on the Freedom of Business index is positive and does not have a

vividly expressed tendency to change: the coefficients range from 0.562 to 0.314 in the period 1995 - 2017. The linear dependence of Financial Development index on the Financial Freedom index is positive in the period 1995 – 2017 (except for the year 2006), although it becomes weaker: from 0.552 to 0.236. However, during the years of recession there was a sharp decrease of the linear dependence, followed by an increase. The linear dependence of the Financial Development index on the Freedom of Investment index was positive in the period 1995 – 2017. Despite some fluctuations, it tends to increase (in 1995, the value of correlation coefficient comprised 0.216; by 2017 it increased to 0.470).

The ideas by Huybens and Smith (Huybens & Smith 1999) about the negative impact of inflation on financial development were partially confirmed: the influence of inflation on financial development is characterized by a linear dependence. However, from 1995 to 2013 it was negative (the correlation coefficient ranges from -0.330 to -0.739), i.e. it had a negative impact on financial development. From 2014 to 2016 it was positive (the correlation coefficient ranges from 0.104 to 0.379); in 2017, it was negative again (the correlation coefficient comprised -0.402).

Levine's ideas (Levine 2005) about the impact of investment in fixed capital on financial development in the EU countries are confirmed. There is an extremely weak linear dependence during both the pre-recession and post-recession period. The linear dependence is expressed by the average value of Pearson correlation coefficients during the recession and economic recovery periods.

The following conclusions can be drawn about the determinants of financial development of the EU countries in the period 1995-2017:

- 1) the impact of the determinants of openness, political stability characterizing the state of political rights and civil liberties, and financial liberalization with the increasing influence of government regulation on financial development of the EU countries in the period 1995 – 2017 is decreasing significantly;
- 2) the impact of the determinant of legal traditions which includes judicial independence, impartial courts, protection of property rights, etc., as well as the impact of the determinant of economic institutions on financial development of the EU countries in the period 1995 – 2017 remain very strong;
- 3) there are divergent trends (both enhancing and weakening) of the impact of the considered macroeconomic indices on financial development of the EU countries in the period 1995 - 2017.

It is obvious that the abovementioned determinants to a greater or lesser extent affect the financial development of the EU countries, but the degree of their influence varies during the period under study.

References

- Acemoglu, D., Johnson, S. and Robinson, J.A. (2005). Institutions as the Fundamental Cause of Long-Run Growth, in: *Handbook of Economic Growth*, Volume IA. Edited by Philippe Aghion and Steven N. Durlauf. <https://economics.mit.edu/files/4469>
- Acemoglu, D., Johnson, S. and Robinson, J.A. (2004). Institutions as the Fundamental Cause of Long-Run Growth, No 4458, CEPR Discussion Papers, C.E.P.R. Discussion Papers <https://EconPapers.repec.org/RePEc:cpr:ceprdp:4458>.
- Acemoglu, D., Johnson, S. and Robinson, J.A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, 91(5), 1369 – 1401. <https://economics.mit.edu/files/4123>
- Acemoglu, D., Johnson, S. and Robinson J.A. (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics*, MIT Press, 117(4), 1231-1294. <https://economics.mit.edu/files/4127>

- Acemoglu, D., Johnson, S., Robinson, J. and Thaicharoen, Y. (2003). Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth. *Journal of Monetary Economics*, 50, 49–123. <https://economics.mit.edu/files/4434>
- Acemoglu, D., Johnson, S. and Robinson, J.A. (2005). Institutions as the Fundamental Cause of Long-Run Growth, in: *Handbook of Economic Growth*, Volume IA. Edited by Philippe Aghion and Steven N. Durlauf O. Elsevier B.V. <https://economics.mit.edu/files/4469>
- Acemoglu, D. and Robinson, J. (2006). De Facto Political Power and Institutional Persistence. *American Economic Review*, 96(2): 325-30. <https://economics.mit.edu/files/4474>
- Amin, A. (1999). An Institutional Perspective on Regional Development. *International Journal of Urban and Regional Research*, 23: 365-378. <http://www.bp.ntu.edu.tw/wp-content/uploads/2011/12/14-Amin-An-Institutionalist-Perspective-on-Regional-Economic.pdf>
- Arestis, P. (2005). Financial liberalization and the relationship between finance and growth, *CEPP Working Paper* No. 05/05, University of Cambridge. https://www.landecon.cam.ac.uk/research/real-estate-and-urban-analysis/centres/ccepp/copy_of_ccepp-publications/wp05-05.pdf
- Arestis, P. and Demetriades, P. (1997). Financial development and economic growth: assessing the evidence, *Economic Journal*, 107: 783–799.
- Arestis P., Demetriades, P.O., Bassam, F., and Kostas, M. (2002). The impact of financial liberalization policies on financial development evidence from developing economies, *Discussion Papers in Economics* 02/1, Department of Economics, University of Leicester. <https://www.le.ac.uk/economics/research/RePEc/lec/leecon/econ02-1.pdf>
- Beck, T. (2002). Financial development and international trade: is there a link? *Journal of International Economics*, 57, 107–131. http://siteresources.worldbank.org/INTEXPCOMNET/Resources/Beck_2001.pdf
- Beck, T., Demirgüç-Kunt, A., and Levine, R., (2001). Law, Politics, and Finance, *Journal of Financial Economics*, 70(2003), 137–181. <http://www.sef.hku.hk/~wsuen/teaching/year2/Law.pdf>
- Dixit, A.K. (2004). *Lawlessness and Economics: Alternative Modes of Governance*. Princeton University Press, Princeton, NJ. <https://pdfs.semanticscholar.org/05ec/0dd58d72dd50b70ce33f658995d3fdef5256.pdf>
- Caplinska, A., Ohotina, A. (2019). Analysis of financial literacy tendencies with young people. *Entrepreneurship and Sustainability Issues*, 6(4), 1736-1749. [https://doi.org/10.9770/jesi.2019.6.4\(13\)](https://doi.org/10.9770/jesi.2019.6.4(13)).
- Economic Freedom of the World. (2019). *Annual Report* <https://www.fraserinstitute.org/studies/economic-freedom>
- Greif, A. (2000). The Fundamental Problem of Exchange: A Research Agenda in Historical Institutional Analysis. *European Review of Economic History*, 4(03), 251-284. https://web.stanford.edu/~avner/Greif_Papers/2000%20EREH%20Fundamental%20Problem.pdf
- Čižo, E., Ignatjeva, S., Lavrinenko, O. (2018). Assessment of convergence processes of financial depth indicators in states with different levels of economic development. *Journal of Security and Sustainability Issues*, 7(3), 459-476. [https://doi.org/10.9770/jssi.2018.7.3\(8\)](https://doi.org/10.9770/jssi.2018.7.3(8))
- Hodgson, G.M. (2006). What Are Institutions? *Journal of Economic Issues*, 40(1): 1-25. <http://www.geoffrey-hodgson.info/user/bin/whatareinstitutions.pdf>
- Huang, Y. (2005). Will political liberalisation bring about ...financial development? *Bristol Economics Discussion Paper* no. 05/578. <https://core.ac.uk/download/pdf/7352590.pdf>
- Huang, Y., & Temple, J. R. W. (2005). Does external trade promote financial development? *CEPR Discussion Paper* No. 5150, London.
- Huybens, E. & B. D. Smith. (1999). Inflation, financial markets and long-run real activity. *Journal of Monetary Economics*, 43(2), 283-315. <https://www.sciencedirect.com/science/article/abs/pii/S0304393298000609>
- Katan, L., Masiuk, I., Oliynik, T., Oliynik, O., Zablotskyi, V. (2019). Ensuring complex security of the financial flows movement in the national economy system. *Journal of Security and Sustainability Issues*, 9(1), 39-50. [https://doi.org/10.9770/jssi.2019.9.1\(4\)](https://doi.org/10.9770/jssi.2019.9.1(4))
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny. (2002). Government Ownership of Banks. *Journal of Finance*, 57(1): 265-301. <https://dash.harvard.edu/bitstream/handle/1/30747188/w7620.pdf?sequence=1>

Levine, R. (2005). Finance and growth: theory and evidence, *Handbook of economic growth 1*: pp. 865–934. http://faculty.haas.berkeley.edu/ross_levine/Papers/Forth_Book_Durlauf_FinNGrowth.pdf

Načisčionis, J., Skrastija, U., Tumulavičius, V. (2018). Secure development of public administration. *Journal of Security and Sustainability Issues*, 8(1), 87-102. [https://doi.org/10.9770/jssi.2018.8.1\(8\)](https://doi.org/10.9770/jssi.2018.8.1(8))

Nadhir, Z., Wardhani, R. (2019). The effect of audit quality and degree of international Financial Reporting Standards (IFRS) convergence on the accrual earnings management in ASEAN countries. *Entrepreneurship and Sustainability Issues*, 7(1), 105-120. https://jssidoi.org/jesi/uploads/articles/25/Nadhir_The_effect_of_audit_quality_and_degree_of_international_Financial_Reporting_Standards_IFRS_convergence_on_the_accrual_earnings_management_in_ASEAN_countries.pdf

North, D.C., and Thomas, R.P. (1973). *The Rise of the Western World -- A New Economic History*. Cambridge: Cambridge University Press. https://eh.net/book_reviews/the-rise-of-the-western-world-a-new-economic-history/

North, D.C. (1990). *Institutions, Institutional Change and Economic Performance*. New York: Cambridge University Press.

Novickytė, L., Pedroja, G. (2014). Banking consolidation as value creation to the buyer and the financial system (case of Lithuania). *Journal of Security and Sustainability Issues*, 4(2), 159-173. [https://doi.org/10.9770/jssi.2014.4.2\(5\)](https://doi.org/10.9770/jssi.2014.4.2(5))

Puryaev, A., Puryaev, A.A. 2019. Mathematical tooling of accounting non-economic characteristics during the assessing process of investment project effectiveness. *Entrepreneurship and Sustainability Issues*, 7(2), 1114-1135. [http://doi.org/10.9770/jesi.2019.7.2\(23\)](http://doi.org/10.9770/jesi.2019.7.2(23))

Rodrik, D. (2005). Growth Strategies. In P. Aghion & S. N. Durlauf (Eds.), *Handbook of Economic Growth*, 1 ed., Vol. 1, pp. 967-1014.

Stiglitz, J. (2000). Capital Market Liberalization, Economic Growth and Instability. *World Development*, 28(6), 1075–1086.

Stulz, R. M. & R. Williamson. (2003). Culture, openness, and finance. *Journal of financial Economics*, 70(3), 313–349. <https://cpb-us-w2.wpmucdn.com/u.osu.edu/dist/0/30211/files/2016/05/Culture-24zmiv8.pdf>

Subačienė, R., Alver, L., Brūna, I., Hladika, M., Mokošová, D., Molín, J. 2018. Evaluation of accounting regulation evolution in selected countries. *Entrepreneurship and Sustainability Issues*, 6(1), 139-175. [http://doi.org/10.9770/jesi.2018.6.1\(11\)](http://doi.org/10.9770/jesi.2018.6.1(11))

The-world-factbook <https://www.cia.gov/library/publications/resources/the-world-factbook/>

Voghouei, H., M. Azali, & M. A. Jamali. (2011). A survey of the determinants of financial development. *Asian-Pacific Economic Literature*, 25(2), 1–20.

Zingales, L. (2003). The Weak Links. *Federal Reserve Bank of St. Louis Review*, 85(4), 47–52.

Zingales, L., Rajan, R. (2003). *Saving Capitalism from the Capitalists*. New York: Random House <http://pavroz.ru/files/zingales.pdf>

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LIAISONS BETWEEN CULTURE AND INNOVATION: COMPARATIVE ANALYSIS OF SOUTH KOREAN AND LITHUANIAN IT COMPANIES*

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Abstract. The present publication is centred on the key liaisons of Innovation (Kane et al. 2019, Marwede and Herstatt 2019, Kremer et al. 2019, Narayan, 2019, Laužikas and Miliute 2017, 2019a, 2019b, and etc.) and Culture (Laužikas and Mokseckiene 2013, Boon et al. 2019, ASUG, 2019, Clercq and Pereira 2019, and etc.) as two separate components of innovation climate as well as the main effects of combination of these dimensions on business sustainability (Collett et al. 2019, Halim et al. 2019, Sull et al. 2019, Jin et al. 2019, and etc.). **The research problem** is how to acknowledge and excel in the areas, related to ‘Innovation-Culture Symbiosis’, without limiting the progress of innovation or human resource management as separate departments and not stopping a firm from strengthening its competitive advantages, driven by the combination of these dimensions. This is relevant and innovative, because nowadays a great number of efficiency and innovation-driven economies or high-tech industries face the necessity to identify, acknowledge and mitigate weaknesses in human resource or R&D performance as well as link these dimensions towards innovation culture via modern technologies, innovative managerial processes, strategic collaboration and creative leadership. **The purpose of the present paper:** comparing the key dimensions of ‘Innovation-Culture Symbiosis’ in high-tech firms of South Korea and Lithuania (both are education-driven countries) it is expected to illustrate the dynamics of a holistic system of innovation and culture, where these two dimensions are interdependent and form a unique equilibrium (which corresponds to a specific economic and business development stage, position in the value-chain as well as cultural and

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social norms of a country). Taking into account that sustainable business calls for continuous improvement of products and processes via HRM techniques, R&D, innovation and technology, the present research results are pertinent and value-adding to high-tech companies of both economies: they could help reach healthier equilibrium between innovation and culture within a specific socio-economic context, and contribute to the establishment of monitoring models which track the dynamics of innovation culture and lead to the bigger economic and social value-added. Taking into consideration the trans-disciplinary holistic nature of innovation culture, which requires a rich knowledge and experience within the present topic, **the semi structured interviews with experts** of Lithuanian and South Korean IT firms were conducted, the research results of the two economies were compared, and recommendations were provided for both high-tech experts and governmental policy or program developers.

Keywords: culture; innovation; climate; symbiosis; technologies; HRM, high-tech; leadership; strategy; competitive advantages

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1. Introduction

The research topic of the present publication is gaining its popularity and momentum: the relation between culture and innovation is being examined via inter-related factors and methodologies. For instance, Kambiz et al. (2018) conducted the survey with 279 companies (providers of automobile parts to Iran Khodro Company) and tackled how innovation was affected by a set of factors, such as organizational culture, knowledge management and organizational learning via combination of knowledge-based approach, competitive advantages framework and identification of main drivers and barriers. Notwithstanding Narayan's (2019) overviewed evolution of the concept of Innovation (from renewing contracts during the 13th century to Schumpeter's intellectual paradigm of innovation or technological and sustainable innovation processes) sustainability, which is a key link between innovation and culture, still leaves a lot of space for interpretation and untapped potential of creating and measuring economic and social value-added. Thus, 'Innovation – Culture' symbiosis might generate synergy effect, if preconditions, such as strategic collaboration or technology, are implemented. Abrahamsen et al. (2016) emphasized business collaboration within networks as an important factor to reach sustainable performance in the context of socio-technical efficiency and effectiveness (Pfote-nhauer and Jasanoff, 2017). Moreover, new technological collaboration possibilities, knowledge sharing and ideas generation or commercialization via modern technologies (such as Blockchain and IT) in a more generic sense could open new horizons and strategic directions as well as contribute to the future where technical and human capital is complimentary (Narayan's, 2019).

Creativity is another important link between innovation and culture. Taking into account the intensity and diversity of creative activities/ projects and growth of the EU Creative Industries, superior than GDP growth, a more thorough look should be taken at what and how innovation models are implemented in these creative sectors as well as how these models could be connected to the present research problem. For instance, having twenty-three semi-structured interviews with creative industries' experts of the Netherlands conducted, Koehorst et al. (2019) introduced a model which is partly in line with business intelligence cycle and contains a set of steps from an idea to its commercial value, such as challenge/ context identification, creative ideas generation, draft and/ or complete design, process implementation, and product introduction. Although creative industries are rather specific in terms of business dynamics, the positive experience of creative industries could be of significant value-added to other creativity-driven sectors, including high-tech industries; particularly, when high-tech content is more frequently used. As it could be expected, these industries possess culture, centred on HR functions and individuals' behaviour, as well as team and organizational cooperation with other stakeholders. On the other hand, creative industries are also driven by efficiency and effectiveness on a more strategic level (Carnevale and Smith, 2013), which requires innovative talent development techniques and enhancement of employees' competences in both more and less creative positions of innovation commercialization cycle.

Kremer et al. (2019) also link innovation and culture via creativity which should be facilitated by the HR Department, while observing employees' and teams' behaviour, reshaping attitude and perception towards innovation, paying the attention to listening and knowledge sharing, as well as perfecting managers' and leaders' performance via sustainable and technology-driven learning system. Monitoring and motivating should be executed at different levels (including a rich diversity of managers, leaders and experts, along with 360-degree performance appraisals); hence, engaging stakeholders might contribute to a larger synergy effect and stronger organizational culture (Aguinis, 2019).

Based on Digital Business Report (MIT SMR and Deloitte, 2019) where more than 4,800 managers were interrogated, digitalization and quality of innovation process play an important role in organizations. The survey accentuates the specificity of digitally maturing companies: they are capable to reach success via digital ecosystems and cross-functional teams along with innovative management techniques. Given the innovation intensity in strongly digitalized companies (81% of companies are driven by innovation versus 10% in young businesses), innovation at a team-level helps raise social trust, self-esteem and motivation, thanks to better-developed innovation culture and its edginess: employees get sufficient time and autonomy for creative activities; they believe in organizational and individual capabilities to adapt to the market trends or implement successful innovation, while less digitalized companies consider innovation as inevitable consequence of market change (when a company has no choice). Organizational openness is a main driver of 80% of highly digitalized organizations involved in key strategic partnerships with other organizations (versus 33% of early-stage companies). Innovation at a team-level is driven by cross-functional activities and innovation culture, based on social norms and ethical standards (76% of digital-maturity companies versus 43% of young business). Notwithstanding its digital maturity, only 35% of leaders focus on social value-added of digital initiatives and address adequate dissemination practices of such initiatives (MIT SMR and Deloitte, 2019).

The positive experiences of digitally more mature companies or innovation leaders across various industries reveal the significance of innovation culture, based on organizational openness, strategic partnerships, and lifelong learning, particularly in the areas of technologies.

2. Innovation-Culture Symbiosis

Waheed et al. (2019) argue that insufficient or fragmented innovation climate limits employees' and organizational creativity; hence, HR management could help engage and empower employees in order to innovate and perform at their best; however, a holistic approach to innovation culture should be developed. Within their survey of employees from the registered IT companies, Qaiser Danish et al. (2019) drew attention towards entrepreneurial culture which embraced attitudes, values, skills, authority and risk at organizational level as well as linked the key dimensions of creativity and readiness for change.

Jin et al. (2019) accentuate sustainability as a key connection between innovation and culture, although efforts of quantifying and measuring this relationship should be analysed through the context of firms' size, development cycle and strategic performance, which in many cases is related to organizational culture. Through the lens of available and allocated inputs for strategic expenditures, the authors come to conclusion that innovation culture incorporates the whole decision-making process along with strategic directions (for instance, sustainability) which affects future outputs via innovation commercialization models. Notwithstanding somewhat bigger financial capacity (available assets) in bigger companies (which creates extensive opportunities to reach innovation-culture synergy effect), both bigger and smaller companies might generate sustainable value-added from R&D and innovation when strategic directions are related to sustainability and strategic directions derive from organizational culture. Therefore, in parallel with the orientation of strategic directions towards sustainability, a holistic approach to innovation culture should be implemented. For instance, Brem and Utikal (2019) examine how work schedule autonomy affects 233 participants' creativity and efficiency (routine performance) and bring

significant implications to organizational managers and leaders: decentralizing work-time planning may affect creativity to the extent of employee's impulsiveness; therefore HR leaders should acknowledge and understand well individual characteristic of each employee in order to optimize their performance.

In light of demographic changes, Marwede and Herstatt (2019) invite corporations to pay more attention to 65+ generation's adults while using the concept of psychological or cognitive distance in the Innovation Department. The representatives of this target group often struggle with using modern technologies; thus, getting socially closer to these customers/ clients requires unique consumer engagement tools, oriented to this demographic group, along with team members and leaders who acknowledge the peculiarities of this target group and make consumer experience smoother and pleasant.

While comparing the cases of leading companies, Sull et al. (2019) identify culture as a driving force of corporate organizations, thanks to its holistic nature (which incorporates a set of values, such as agility, collaboration, customer, diversity, execution, innovation, integrity, performance, and respect). As it could be expected employees' perception regarding the role of innovation in business is more optimistic in technologically more intensive industries, such as Semiconductors, Tech Giants, Communication Equipment or Enterprise Software (standard deviations above or below the mean score across all industries of 2.51, 2.21, 1.38 and 1.14 respectively), while Regional Banks, Grocery stores, Airlines or Insurance industries could be examples of a somewhat more negative sentiment of innovation with -2.74, -1.37, -1.22 or -1.16 respectively. The examples of leading companies that commit to values might also change stakeholders' behaviour.

Drawing the parallel with cultural and creative organizations' orientation towards economic and social value-added, Deloitte's (2019) reveals Global Human Capital Trends survey results (with 10,000 respondents in 119 countries), where a special attention is paid to social enterprises that focus on technology-driven innovation culture, centred on effectiveness and efficiency. For instance, although social players are rapidly improving their cloud-based HR systems, only 5 percent of respondents possess a fully integrated HR cloud platform. Moreover, these platforms should be liaised with cognitive technologies, AI, and robotics, while digitalization of work-life should increase comfort and satisfaction of human resources via apps and hubs or employee mobility and engagement schemes.

Within the National Artificial Intelligence Research and Development Strategic Plan 2019 update, the experts of the USA White House link innovation and culture with the dimension of AI R&D workforce (which incorporates both R&D and Human Resource strategies), because, according to the U.S. Bureau of Labor Statistics (2019), human capital in terms of numbers of researchers (for instance, computer and information scientists and engineers) will show improvement of 19% from 2016 to 2026 (showing three times superior improvement than for other positions), while intelligent technologies in the G20 countries should add \$11.5 trillion turnover (Accenture, 2018). In order to supply sufficient numbers of AI R&D graduates, the government should direct their programs and policies towards an innovative education system with its connections to the corporate world, because the future AI or IT graduates will drive further growth across various industries.

The White Paper on Innovative Leaders, written by Collet et al. (2019) addressed the relation between innovation and leadership as an engine of sustainable performance. Their investigation led to the implications that leaders were important intermediaries between innovation and culture: they enhanced creativity systems and knowledge sharing processes as well as demonstrated examples to other colleagues or led them in rapidly transforming internal and external strategic collaboration via modern technologies.

While investigating food and high-tech industries in Norway and Germany (explorative qualitative action research), Gonera and Pabst (2019) went one step further and interpreted the liaison of culture and innovation as impacts of Design Thinking techniques and Research and Innovation Consortia on competitive advantages of organizations. The researchers identified the value-added of using Design Thinking and Research and Innovation

Consortia (which were related to users' engagement and innovation focus) as well as revealed how Design Thinking helped R&D and Innovation Centres scientifically codify business expectations and/ or practically apply research results in order to strengthen innovation-related competitive advantages of various organizations. This clearly illustrated how organizational culture (including thinking, creating, knowledge sharing, and conducting research) is important, when stakeholders come from completely different backgrounds and environments, marked by diverse variety of status, strategic targets and multifaceted communication styles.

The liaisons of innovation and culture are interpreted at both micro and macro levels. For instance, Mickov and Doyle (2019) link Culture and Innovation with the Economy, while testing this symbiosis via cultural entrepreneurship cases and practices. Such approach indicates that the liaison of innovation and culture generates value-added to both business and economy, as cultural economy can be interpreted as a business, while creative businesses generate a solid value-added to GDP.

Relying on Uwe Palm's (2019) presentation in ASUG Annual Conference, only an organization with innovation-driven culture can succeed in digital transformation, led by collaboration, HR innovation, design-thinking, data management, and intuitive leaders. Moreover, technological improvements should derive from culture, mindset, and strategy, while outcomes should be foreseen, forecasted and tracked in both the shorter and longer run.

Creativity enhancement should be a starting point while linking innovation and culture at different hierarchy levels, while positive experiences of this connection can be witnessed across various regions and countries. For example, the initiative of National Innovation Foundation India to lead the Festival of Innovation and Entrepreneurship (2019) is a good example of recognizing and rewarding citizens' creativity and drawing attention to combination of Science, Technology and Innovation, which in parallel encourages entrepreneurship and engage society. Thus, we can speak about innovative society and bring innovation culture at national level or different sectors and industries of a country, such as Healthcare, Agriculture or Environmental Protection.

Kim et al. (2019) agree that technological improvement expenditure is crucial to strengthen technological competitiveness: modern technology might negatively affect profit margins in the shorter run and might improve profitability in the longer run. While interrogating 183 Malaysian SMEs, Halim et al. (2019) interpret innovation-culture symbiosis from the perspective of effects of organizational culture, learning and marketing on innovation success, where data collection, behavioural and cognitive patterns emerge as the key dimensions of innovation process. The authors conclude that innovation climate/ culture is critical for entrepreneurs, while managers should take into account that innovation might cause opposition, thus this phenomenon requires continuous enhancement and motivation along with strategic and innovative HRM techniques.

3. Perception of innovation culture across various industries and economies

The interpretation of Innovation-Culture symbiosis differs across various industries and economies. Schoff and Ito (2019) overviewed American and Japanese scholars' insights regarding changing global competitive trends (related to emerging China), presented during the Japan Forum on International Relations (JFIR) and the Carnegie Endowment for International Peace. It is worthy to have a thorough look at competition with China in terms of high-tech innovation. On the one hand, Manufacturing process improvement, Apps, Digital Hubs and R&D advancement help this technological giant to target over 1 billion local consumers and 800 million internet users, which might lead to introduction of new technological standards and trends (including high-tech control, ethical standards, competition policy) as well as military edge. On the other hand, China's transformation in terms of collaboration projects with strategic partners from other countries and shifting attitude towards innovation as a public property with less control and more digital, shared value economy could lead the world to new social innovation paradigm.

Atkinson and Foote (2019) identify similar trends in China's attempts to catch up other innovation-driven economies: China's innovation strategies (China 2025), accompanied by its R&D efforts and solid HR supply, are oriented to high-tech development and application of high-tech content in other industries, which indicates that

this economy is bit by bit accelerating its innovation processes. Therefore, other peers, such as the US, should address their national policies to improve its competitive technological advancement compared to other regions. Yardeni et al. (2019), recommend thinking outside the box, and based on the US's experience, pay more attention to R&D and high-tech performance.

Apart from focusing on innovation trends among giant economy leaders, such as China, South Korea, the USA, it is worth overviewing Innovation in smaller economies, such as Israel. Innovation in Israel overview, prepared by Israel Innovation Authority (2019), outlined that this entrepreneurial opportunity-driven country focus on leveraging untapped potential of high-low tech combination via improving high-tech ecosystem in Jerusalem and Beersheba (encouraging research universities and hospitals, technological entrepreneurship, and corporate R&D centres) as well as intensifying research and innovation in technologically less intensive agriculture sector or industrial development (for instance, hubs for knowledge sharing and collaboration) along with governmental programs and initiatives for technological and knowledge upgrading of various industries.

An interesting insight could be found in the European Innovation Scoreboard Methodology Report (European Commission, 2019), where in spite of cultural differences, a set of indicators, such as human resources, attractive research system and innovation-driven environment should be taken into consideration while linking culture with innovation, while a successful innovation-culture symbiosis could contribute with employment and sales impacts (one is related to social, cultural and intellectual aspect, and another refers to economic and social value-added).

Although, based on EUROSTAT (2019), in 2017, the R&D expenditure of GDP was superior than 3% in Sweden, Austria, Denmark and Germany, the overall EU's performance in terms of R&D efforts stood at 2.07% in 2017, compared to 4.22% in South Korea (in 2015) or 3.28% in Japan (in 2015). Such results might indicate a weak link between innovation and culture and should be incorporated into key-priority innovation policies, programs and strategies.

Based on Deloitte Technology Fast 50 Report for Central Europe (2019), it is important to identify and reward the fastest growing High-Tech companies (based on 4-year revenue growth, 2015-2018) in the region of Central Europe, which is rapidly shifting to Innovation-edge stage and improving its high-low tech combination. The initiative is based on digital hub through which companies from a rich diversity of sectors (such as Communications, Environmental Technology, Fintech, Hardware, Healthcare and Life sciences, Media and Entertainment, Software, and etc.) self-nominate, provide and check financial data and choose their winner. Recognition of peers is a worthy pursuit for innovation performance, while feeling better the local and global environment (as it is part of Deloitte's global Fast 500 program) and initiating important collaboration projects.

Based on European Commission's Independent Expert Report '100 Radical Innovation Breakthroughs for the future', although it is getting difficult to generate a creative idea for radical innovation (for instance, in the area of holistic health) it is even more challenging to run the whole commercialization process of breakthrough innovation: such innovation could contribute to better life quality of people and create bigger social value-added. Not surprisingly, among 100 presented radical innovation examples, 87% were related to emerging technologies, while only 13% corresponded to new social practices. This statistical evidence reveals that there is a huge untapped potential for organizational leaders to combine Culture and Innovation in order to generate social value-added and start the sustainability agenda for future generations.

4. Methodology

The in-depth qualitative semi structured interviews with 6 Lithuanian and 6 South Korean IT companies drew attention to the importance of culture in high-tech industries, in particular when modern technologies (such as Artificial Intelligence, IT, Nano technologies, Mechatronics/ Robotics or Biotechnologies) help more traditional companies to raise business efficiency. The culture could be centred around different departments, such as R&D, Production, Marketing/ Sales, Communication, HR or Business Intelligence, and etc.

To justify the choice of countries for the comparative analysis, first of all, a set of questions were asked to identify the main drivers of entrepreneurship dynamics of the selected economies. The diagram revealing the role of various factors (in terms of entrepreneurship enhancement organizations) on Culture-Innovation Symbiosis supports the selection of South Korea and Lithuania as research objects of comparative analysis: both countries drive the innovation culture via education and cultural and social norms. Although Governmental Programs and Finance organizations show more support for high-tech business in South Korea, Lithuanian experts stressed the need to reshape the Lithuania's R&D transfer system and unleash its potential in facilitating knowledge sharing, creativity enhancement and social trust building.

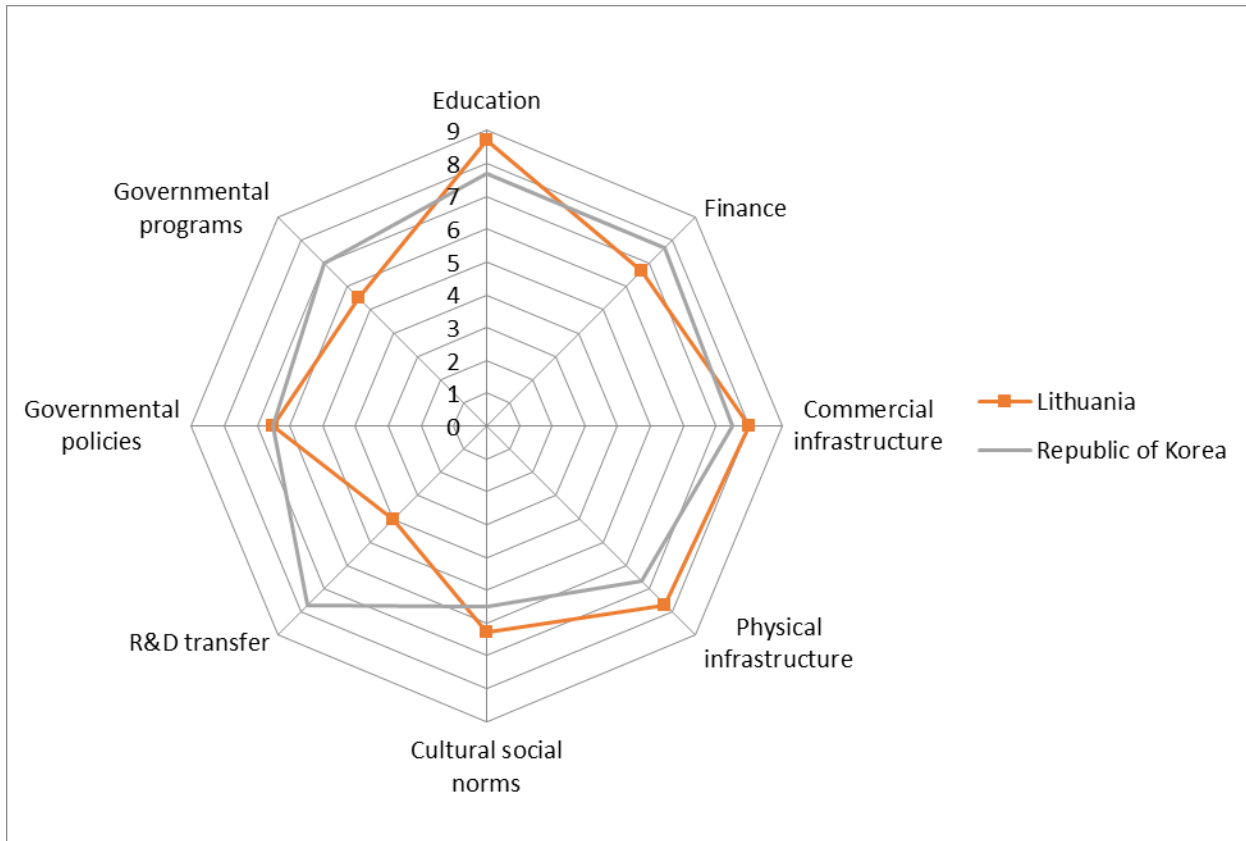


Image 1. The role of entrepreneurship enhancement organizations on innovation culture of high-tech companies.

Source: Prepared by paper authors, based on experts' responses

Having two economies (Lithuania and South Korea) chosen for comparison, based on its main innovation drivers (education and knowledge), further on, the top managers with over 7-year experience in IT business were selected and the questionnaire developed in order to identify the main dimensions of 'Innovation-Culture Symbiosis'. Moreover, the coded responses led to comparative results and recommendations for both high-tech companies and experts of Governmental Programs and Policies in South Korea and Lithuania.

5. Research on Innovation Culture Dimensions in Lithuanian and Korean IT Companies

Specifying the main success factors/ KPI-s or value-added indicators, all the interrogated experts from South Korea agreed that technologies might free-up time, help cut cost, affect profitability, brand/ image, market share, growth, efficiency, and many other indicators; however, all these factors should be adapted to a specific context of an economy, industry and, in particular, a company. Thus, innovation climate and organizational culture are

mentioned as the most important preconditions for technological development, innovation commercialization and organizational competitive advantages in general.

Identifying the most relevant technologies, the IT top managers from south Korea and Lithuania focused more on specificity of their clients' industries or economies overall. For instance, South Korean experts mentioned production-related innovative products or processes, such as electric vehicles, renewable energy technologies for buildings and houses, physical cyber systems to emulate real machines and equipment or Matlab® (multi-purpose engineering commercial program); only one expert emphasized the increasing role of AI and big data application. The interrogated Korean experts acknowledged modern technologies' significance in improving efficiency of team leadership, talent development and creativity enhancement functions, which illustrated that their companies already had a well-established innovation climate; moreover, modern technologies were considered as a compulsory factor to strengthen competitive advantages. For instance, one expert from South Korea stated that using Matlab facilitates application of AI in the development of more competitive products is important, while without seamless application capability of using AI and big data companies would face the decline or would terminate operations in the nearest future.

Moreover, a well-established innovation culture and innovative human resource management techniques help free-up time and resources for new technological innovations, in line with employees who are more confident to initiate new projects, share knowledge with other stakeholders. Thus, innovative culture leads to innovation, while innovation help improve innovative culture via digital solutions. Driven by Lithuania's Innovation strategy directions, the interviewed Lithuanian high-tech experts emphasized the role of IT, Lasers and Biotechnologies, while focusing on institutional sales of services and goods, deriving from R&D, open-source innovation/ digital hubs as well as mobile application services. All the Lithuanian experts accentuated the role of modern technologies in knowledge sharing, lifelong learning, and strategic collaboration; nevertheless, many aspects of cultural and social norms (such as social trust, creative leadership or creativity enhancement) according to the respondents, were not in favour of innovation and held innovation processes back. Thus, a special attention should be paid to innovation climate, culture in order to use the potential of divergent thinking or mitigate unpleasant effects of fear of failure, and lack of confidence in entrepreneurship/ intrapreneurship capabilities.

According to the Lithuanian experts, employees and other stakeholders are often not integrated into decision-making process; hence, innovation comes first and culture should adapt to it. Such strategy is very dangerous in an economy, characterised by its high-education levels and limited natural resources: in order to compete among other innovation-driven economies, culture should help unleash employees' potential, encourage them to embrace new innovations, raise self-esteem and belief in their knowledge and skills. Therefore, the South Korea's experience in supplying an adequate number of high-tech experts for foreign investors from the perspective of governmental programs and education innovation along with Korean companies' experience in developing effective/ efficient innovation climate with a corresponding creativity system would be of significant value to Lithuanian governmental authorities, universities and firms.

In order to improve innovation processes, first of all, the creativity system should be implemented and innovation processes established. When culture does not come first, it is very difficult to reach sustainable competitive advantages via technologies: stakeholders do not understand what strategic direction they follow, what value-added they could create and why they apply a particular technology in one or another context.

To continue, technological advantages could be related to the main specialization areas of interrogated companies; for instance, the interrogated Korean experts emphasized that their organizations competitiveness is a technology which uses AI to improve the process control and data utilization capabilities of existing industries, along with big data analysis capability, customer-oriented AI programming, and high reliability technology of AI utilization performance. Such description of the analysed companies leads to understanding how culture is linked to innovation through big data management; in parallel, employees should be technology-intuitive, feel the

consumer context well and be capable to customize the analysis, based on client companies' development peculiarities. To provide the service of such high standards, a company must definitely have strong creative leaders, educators and HR managers, that are constitutive part of the organizational culture. As it could be expected, the Lithuanian respondents emphasized the role of information technology and mechatronics while creating the innovation culture, collecting ideas, and later on implementing innovation. According to them, innovation processes are faster than culture enhancement mechanisms, which might be explained by the fact that not all innovations derive from a natural creativity system of an organization; very often, innovation processes might be fragmented, one-off or lacking strategic effectiveness. Given all these challenges, Human Resource Management technologies could be of significant value-added, while strategic collaboration via digital hubs could help share knowledge with more advanced organizations, gather community, engage society, and create the desired synergy effect among stakeholders.

Notwithstanding the specialization and a country of origin of high-tech experts, all of them admitted that technological advancement should derive from creativity which is an important part of innovation culture; thus, innovation could not be created without interesting ideas deriving from divergent thinking, fusion of concepts and diverse schemas of thinking. Moreover, culture could help orient technologies towards switching from a niche to mainstream market. One Korean expert admitted that after securing the quality and performance stability of AI applications in its niche market, the same technology can be applied in the mainstream market: "today's technological competitiveness is a creative technology that can be monopolized, which does not require large investment capital".

A similar insight was provided by Lithuanian experts – culture could help adapt to rapidly changing market trends and link stakeholders via user-friendly technology, just because this technology is created through strategic collaboration activities.

The sustainability of technological symbiosis with culture might be a challenge to many companies. For instance, one Korean expert accentuated the significance of adapting technologies to the context of a company (development stage, competitive position in the market, value-chain, management style, and specificity of strategic goals). According to this expert, to leverage the value-added of technologies in order to survive and lead in the market, AI application algorithms should serve many enterprises; the technology should be continuously improved to be unique enough. The other five experts emphasized intellectual property rights: a unique patent strategy should be established to maintain exclusivity and prevent similar patents. Hence, culture should support technology application, while technologies should be effectively and efficiently programmed and customised to unleash potential of organizational culture. It is interesting to note that the Lithuanian experts, contrary to the Korean respondents, drew attention to the risk of treating knowledge and innovation as private property, because it might diminish the role of strategic collaboration and jeopardize potential synergy effects. They emphasized the relevance of open-source innovation platforms and digital hubs, where social value-added could be generated together, while patents are more interpreted in the context of radical innovations.

Taking into consideration that South Korea is one of the leading economies in terms of adults involved in shared value-economy activities (GEM 2018/2019), shared value phenomenon was also underlined among the key priority areas by the interviewed Korean experts. According to the Korean respondents, the usage of shared value economy techniques while linking culture and innovation must be strengthened, while the Lithuanian respondents did not acknowledge this area as a key dimension linking culture and innovation.

Although the Lithuanian experts accentuated process/ product or service innovations in their organizations, they admitted that technological improvement/ upgrade happens once per 2 years or even less frequently, while the Korean respondents reported a more frequent technological improvement practice (once a year). This could be related to more ingenious expertise and culture of the R&D department or higher technological intensity of the

economy and industry. The symbiosis between innovation and culture is centred more on R&D or data management strategies among the South Korean experts (creative ideas generation process is related to customers' feedback in terms of reviews or complaints about current products or the use of big data and AI).

Communication is another important management function, mentioned by the Korean and Lithuanian high-tech experts, as a linking dimension between innovation and culture, although its role on Innovation-Culture Symbiosis is perceived differently by the Asian and Baltic respondents. It is interesting to note, that in spite of the accentuated monopolistic nature of the services provided by modern technologies (it was admitted by 4 Korean experts) along with technical specificity and the role of customization, the technology should be sufficiently advanced and powerful to support communication among a big network of stakeholders, where big quantities of data flow and video content is available; thus, modern technologies could contribute to strategic collaboration among various stakeholders, in particular in the areas of production and processing of big data. The Lithuanian experts emphasized more comfort, cost and management aspects of modern technologies, which are again indirectly related to the dimension of intellectual capital and competences. Having the R&D dimension more accentuated among Korean experts, it is not surprising that the synergy effect among stakeholders is more related to productivity of R&D personnel or headcount in general thanks to the use of AI applications. The Lithuanian high-tech specialists accentuate the development of independent and self-sufficient creativity system thanks to process innovation, initiated via technology-driven collaboration.

As it is illustrated in the image representing the peculiarities of Innovation-Culture Symbiosis in South Korea, the element of culture is well-established in high-tech organizations; therefore, the core focus of companies is related to efficiency and value-added of innovation processes via R&D.

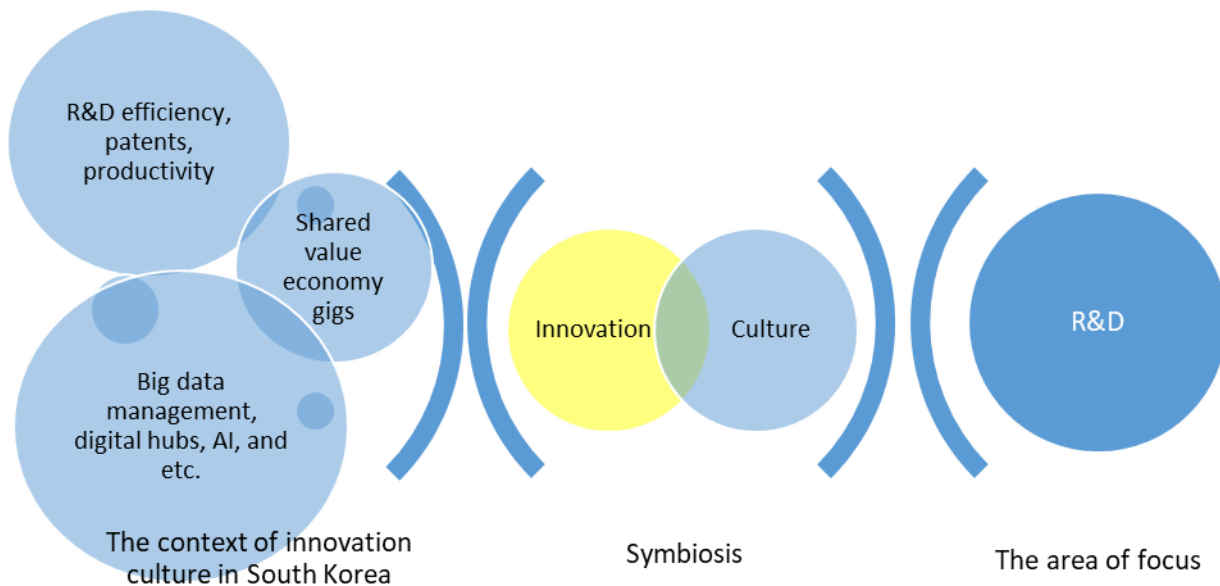


Image 2. Innovation Culture, driven by R&D
Source: Prepared by paper authors, based on experts' responses

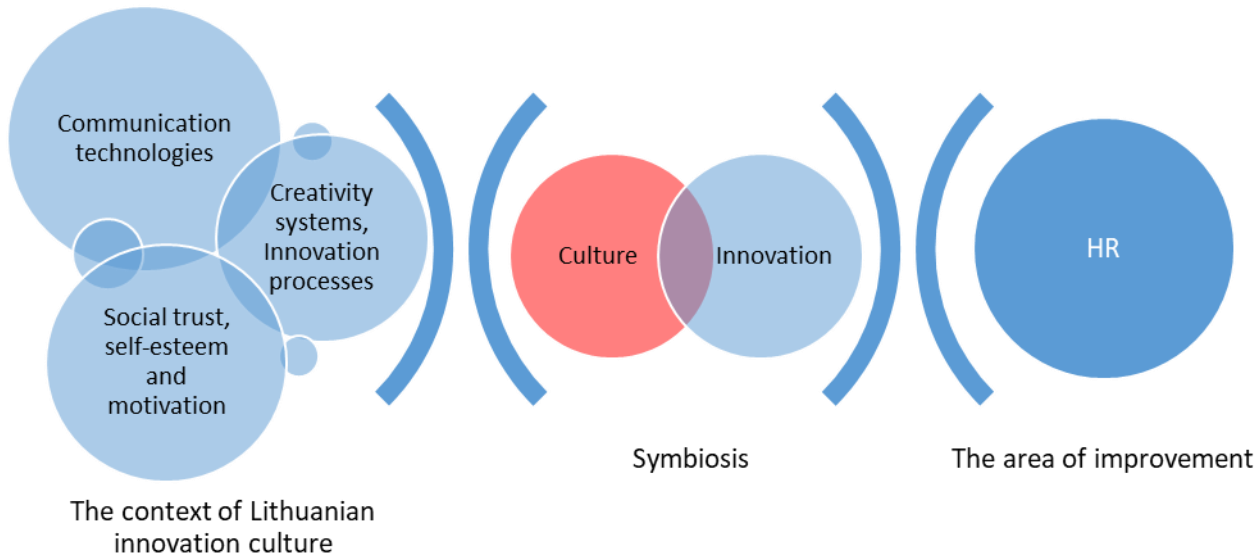


Image 3. Innovation Culture, driven by HRM

Source: Prepared by paper authors, based on experts' responses

The rapid transformation of Lithuanian economy (former USSR state) from Linear to Innovation-driven status still leaves some areas of improvement in terms of culture and/or cultural and social norms via HR performance. Such trend is logical, because social trust, unpleasant effects of fear of failure or lack of transparency could jeopardize knowledge sharing and innovation commercialization processes. In light of innovation-culture symbiosis, where culture comes first (only then innovation strategy could be effectively addressed by decision-makers), the future success of Lithuanian high-tech companies might depend on how fast HRM systems are in building healthy innovation climate (based on cultural and social norms) along with sustainable creativity system and lifelong learning process.

Conclusions and Recommendations

The comparison of innovation culture dimensions in Lithuanian and South Korean IT companies, based on semi structured expert interviews (centred on questionnaire, which derived from scientific literature review), revealed the significance of economic and/ or business development cycles of an economy or a high-tech industry.

Given the assumption that culture should come before strategy and technology, R&D and technological improvement driven South Korean culture already possess all the necessary elements of innovative HR management (including motivation, creativity enhancement and digitalization) thanks to its technological maturity and deeper innovation traditions; while efficiency-driven culture of Lithuanian high-tech industries is more oriented to building fundamental pillars of HR management and creativity system, which could help strengthen competitive advantages, open up to digital networks as well as excel in terms of innovation commercialization processes.

The technological and innovation implementation in Lithuanian companies is more advanced than realignment of culture with innovation processes, which calls for implementation of process managerial technological innovations that could strengthen innovation culture, creativity system and HR Management.

Notwithstanding the similarity between two countries in terms of abundance of human resources and a rich supply of high-tech graduates for technologically-intensive firms, the innovation culture in Lithuanian and South Korean interrogated companies is rather different, due to uniqueness of cultural and social norms and rather different experience of linking culture and innovation.

The present research sheds new light on innovation culture: in order to strengthen fundamentals of innovation culture, decision makers of Lithuanian high-tech companies should analyse the innovation commercialization models of South Korean firms and via HR innovations make innovation process less fragmented, more holistic and knowledge-driven. In the meantime, the Korean high-tech experts should focus on a rapid shift towards employees working hand in hand with robots and other modern technologies as well as the usage of their competitive advantages of R&D culture in responding to global challenges, such as environmental issues (climate change), healthcare, information security, and social innovation. Along with cutting gap between Lithuanian and South Korean high-tech firms in terms of HR efficiency while supporting creativity and innovation, it is anticipated that these two countries will converge in 'Innovation-Culture Symbiosis', because both of them are driven by human capital as a key resource for high-tech companies. Innovative culture should contribute to innovative processes and bigger value-added, while the role of R&D culture should become more important.

References:

- Abrahamsen, M.H.; Henneberg, S.C.; Huemer, L.; Naude, P. (2016). Network picturing: An action research study of strategizing in business networks. *Industrial Marketing Management*, 59, 107-119. <https://doi.org/10.1016/j.indmarman.2016.02.006>
- Accenture (2018). It's learning, just not as we know it. How to accelerate skills acquisition in the age of intelligent technologies, p. 40, https://www.accenture.com/t20180920T094705Z_w_us-en/acnmedia/Thought-Leadership-Assets/PDF/Accenture-Education-and-Technology-Skills-Research.pdf
- ASUG, The State of the Community. (2019). Don't Get Eaten by The Big Fish, Bring Innovation Culture into Your Organization, p. 35, <https://blog.asug.com/hubfs/2019%20AC%20Slide%20Decks%20Wednesday/ASUG84077%20-%20Don%E2%80%99t%20Be%20Eaten%20by%20the%20Big%20Fish%20Bring%20an%20Innovation%20Culture%20into%20Your%20Organization.pdf>
- Atkinson, R.D.; Foote, C. (2019). Is China Catching Up to the United States in Innovation? p. 57, <http://www2.itif.org/2019-china-catching-up-innovation.pdf>
- Boon, C.; Hartog, D.N.D.; Lepak, D.P. (2019). A Systematic Review of Human Resource Management Systems and Their Measurement. *Journal of Management*, 45(6), 2498–2537. <https://doi.org/10.1177/0149206318818718>
- Brem, A.; Utikal, V. (2019). How to manage creativity time? Results from a social psychological time model lab experiment on individual creative and routine performance. *Creativity and Innovation Management*, 28(3), 291-305, <https://doi.org/10.1111/caim.12309>
- Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook (2019). Computer and Information Research Scientists, <https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm>
- Carnevale, A.P.; Smith, N. (2013). Workplace basics: the skills employees need and employers want. *Human Resource Development International*, 16, 491-501, <https://doi.org/10.1080/13678868.2013.821267>
- Clercq, D.; Pereira, R. (2019). Resilient employees are creative employees, when the workplace forces them to be. *Creativity and Innovation Management*, 28(3), 329-342, <https://doi.org/10.1111/caim.12328>
- Collett, C.; Graham, J.; Lindsay, J. (2019). Innovative leaders & leading innovation. A Theoretical and Practical Analysis White Paper. iOpener Institute for People & Performance, An iOpener Institute Research Paper, May, p. 30, <https://iopenerinstitute.com/wp-content/uploads/2019/05/Innovative-Leaders-and-Leading-Innovation-May-2019.pdf>

Danish, R.Q.; Asghar, J.; Ahmad, Z. et al. (2019). Factors affecting “entrepreneurial culture”: the mediating role of creativity. *Journal of Innovation and Entrepreneurship*, 8(14) <https://doi.org/10.1186/s13731-019-0108-9>

Deloitte (2019). Welcome to the Deloitte Technology Fast 50 Central Europe 2019, p. 59, www.deloitte.com/cefast50

Deloitte by Kaji, J.; Hurley, B.; Gangopadhyay, N.; Bhat, R.; Khan, A. (2019). Leading the social enterprise: Reinvent with a human focus, 2019 Deloitte Global Human Capital Trends, p. 112, https://www2.deloitte.com/content/dam/insights/us/articles/5136_HC-Trends-2019/DI_HC-Trends-2019.pdf

Deloitte, prepared by Seeger, S.; Hurley, B.; Bhat, R. (2019). Innovation in Europe. A Deloitte survey on European companies and how digital technologies can strategically enhance innovation, p. 28, https://www2.deloitte.com/content/dam/insights/us/articles/DE_897_Innovation-in-Europe/DI_Innovation-In-Europe.pdf

European Commission, prepared by Warnke P. et al. (2019). 100 Radical Innovation Breakthroughs for the future, p. 338, https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_radical-innovation-breakthrough_052019.pdf <https://doi.org/10.2777/563770>

European Commission, prepared by: Hollanders. H. (2019). European Innovation Scoreboard 2019 – Methodology Report, p. 39, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwiYjPX-h-3mAhVHDuwKHRurCFMQFjABegQIBRAC&url=https%3A%2F%2Fec.europa.eu%2Fdocsroom%2Fdocuments%2F36282%2Fattachme-nts%2F1%2Ftranslations%2Fen%2Frenditions%2Fnative&usg=AOvVaw3LgztKG_V_Iz2NFftv8f-v

EUROSTAT (2019). First estimates of Research & Development expenditure, p. 5, <https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1>

GEM by Bosma, N.; Kelley, D. (2019). 2018/ 2019 Global Report. p. 152 <https://www.gemconsortium.org/report>

Gonera, A., Pabst, R. (2019). The Use of Design Thinking in Transdisciplinary Research and Innovation Consortia: Challenges, Enablers and Benefits. *Journal of Innovation Management*, 7(3), 96-122. https://doi.org/10.24840/2183-0606_007.003_0006

Halim, H.A.; Ahmad, N.H.; Ramayah, T. (2019). Sustaining the Innovation Culture in SMEs: The Importance of Organisational Culture, Organisational Learning and Market Orientation. *Asian Journal of Business Research* 9(2), 20, <https://doi.org/10.14707/ajbr.190059>

Israel Innovation Authority by Gabay, U.; Linzen, N.; Aharon, A.; Gabay, U.; Kaufman, D. (2019). Innovation in Israel overview, p. 52, Available online: https://innovationisrael.org.il/en/sites/default/files/2018-19_Innovation_Report.pdf

Jin, Z.; Navare, J.; Lynch, R. (2019). The relationship between innovation culture and innovation outcomes: exploring the effects of sustainability orientation and firm size. *R&D Management*, 49(4), 607-623. <https://doi.org/10.1111/radm.12351>

Kane, C.G.; Palmer, D.; Phillips, A.N.; Kiron, D.; Buckley, N. (2019). Accelerating Digital Innovation inside and out; Agile Teams, Ecosystems, and Ethics, MIT Sloan Management Review, June 04, Findings from the 2019 Digital Business Global Executive Study and Research Project In collaboration with Sponsor Logo <https://sloanreview.mit.edu/projects/accelerating-digital-innovation-inside-and-out/>

Kim, H.; Park, S.Y.; Joh, W.I. (2019). A Study on Technology Development Performance and Technology Commercialization Performance (According to the Technology Development Capability of SMEs Focusing on a Comparative Analysis of Technology Business Groups). *Journal of Open Innovation: Technology, Market, and Complexity*, 5(3), 65, p. 19, <https://doi.org/10.3390/joitmc5030065>

Koehorst, M.; van Deursen, A.; van Dijk, J.; De Haan, J. (2019). Exploring the Creative Industries: toward a Classification by Process and Job Functions. *Journal of Innovation Management*, 7(3), 69-95. https://doi.org/10.24840/2183-0606_007.003_0005

Kremer, H., Villamor, I., Aguinis, H. (2019). Innovation leadership: Best-practice recommendations for promoting employee creativity, voice, and knowledge sharing. *Business Horizons*, 62(1), 65-74, <https://doi.org/10.1016/j.bushor.2018.08.010>

Lauzikas, M.; Mokseckienė, R. (2013). The Role of Culture on Entrepreneurship in Lithuania. *Social Research*, 2(31), 55–69. ISSN 1392-3110. <https://vb.mruni.eu/object/elaba:6092663/>

Lauzikas M.; Miliutė A. (2017). The Role of Education on Entrepreneurship in Lithuania. In: Sauka A., Chepurens A. (eds) Entrepreneurship in Transition Economies. Societies and Political Orders in Transition. Springer, Cham; ISBN: 978-3-319-57341-0 (Print) 978-3-319-57342-7. https://doi.org/10.1007/978-3-319-57342-7_9

Lauzikas, M.; Miliute, A. (2019a). Transformational Communication via Evolving Ethical and Moral Norms of Lithuanian Civil Service Organizations, Entrepreneurship and Sustainability Issues, 6(4), 1750-1761, [https://doi.org/10.9770/jesi.2019.6.4\(14\)](https://doi.org/10.9770/jesi.2019.6.4(14))

Lauzikas, M.; Miliute, A. (2019b). Communication Efficiency and Effectiveness within Strategic Management of Change: insights into Civil Service Organizations, Journal of Security and Sustainability Issues, 8(4), 617-630, [https://doi.org/10.9770/jssi.2019.8.4\(6\)](https://doi.org/10.9770/jssi.2019.8.4(6))

Marwede, M.; Herstatt, C. (2019). No innovation for the elderly? The influence of cognitive distance in corporate innovation. Creativity and Innovation Management, 28(3), 355-367, <https://doi.org/10.1111/caim.12318>

Mickov, B.; Doyle, J.E. (2017). Culture Innovation Economy, ISBN 1138219010, p. 210

Narayan, R. (2019). Picturing future imaginaries for innovations towards sustainability transitions. Journal of Innovation Management, 7(3), pp. 7–11, https://doi.org/10.24840/2183-0606_007.003_0002

National Innovation Foundation India (2019). Festival of Innovation and Entrepreneurship, p. 69, <http://nif.org.in/upload/fine/A-report-on-Festival-of-Innovation-and-%20Entrepreneur-ship-2019.pdf>

Pfotenhauer, S.; Jasanoff, S. (2017). Panacea or diagnosis? Imaginaries of innovation and the 'MIT model' in three political cultures. Social studies of science, 47(6), 783-810. <https://doi.org/10.1177/0306312717706110>

Schoff, J.L.; Ito, A. (2019). Competing with China on Technology and Innovation, Alliance Policy Coordination Brief, Carnegie Endowment for International Peace, October, p. 17, https://carnegieendowment.org/files/ChinaRiskOpportunity-China_Tech.pdf

Select Committee on Artificial Intelligence of the National Science & Technology Council, the USA (2019). The National Artificial Intelligence Research and Development Strategic Plan: 2019 Update, June 2019, p. 50, <https://www.nitrd.gov/pubs/National-AI-RD-Strategy-2019.pdf>

Sull, D.; Sull, C.; Chamberlain, A. (2019). Measuring Culture in Leading Companies, MIT Sloan Management Review and Glassdoor, June 2019, p.17, <https://www.glassdoor.com/research/app/uploads/sites/2/2019/06/Measuring-Culture-Final.pdf>

Waheed, A.; Miao, X.; Waheed, S.; Ahmad, N.; Majeed, A. (2019). How New HRM Practices, Organizational Innovation, and Innovative Climate Affect the Innovation Performance in the IT Industry: A Moderated-Mediation Analysis, Sustainability 11(621), 21. <https://doi.org/10.3390/su11030621>

Yardeni, E.; Johnson, D.; Quintana, M. (2019). US Economic Indicators: R&D and High-Tech Capital Spending, p. 8, Available online: <https://www.yardeni.com/pub/capspendrdtech.pdf>

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CYBER EFFECT AND SECURITY MANAGEMENT ASPECTS IN CRITICAL ENERGY INFRASTRUCTURES *

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Abstract. The purpose of the paper is to compare various types of management models that regulate the response to cyber threats to Critical Infrastructures. The development of an effective management model that regulates the response to cyber-attack against Critical Infrastructure is an important issue in security management. Many frameworks attempt to regulate the response that has to be done to recover and eradicate possible threats, but still, there is not a universal applicable model for all Critical Infrastructures. The paper will offer a comparison of various frameworks in an attempt of evaluating the features that a hypothetical model for response to Cyber Incidents to Critical Infrastructures. The focus is on Critical Energy Infrastructure, as their damage directly means damage to other critical infrastructures, given their extreme interconnectivity. After the analysis of five frameworks of responses to Cyber Incidents, an evaluation will be provided, along with a recommendation.

Keywords: critical infrastructure; management; cyber-attack; energy security; cybersecurity

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1. Introduction

In our current society, many new issues are affecting the functioning of the sources of energy, which are fundamental for all Critical Infrastructures. With the convergence of IT and OT environments and the birth of IIoT, the security of industrial systems of the critical infrastructure was not adequately updated, hence currently many enterprises are facing cyber risks without any management strategy (Bhayani 2016). While the definition of the adequate modality can vary from one enterprise to another, there should be an effective management model that could offer adequate guidelines in preparing, responding, and reporting a cyber-attack, as well as defining the management roles necessary to handle the operations and the decisions. Frameworks and standards were developed for both IT and OT environments but, as aforementioned, the IIoT represents the overlap of both, hence the model that should be adopted for CI should be taking account of both.

The development of a management model tailored for cybersecurity of critical energy infrastructure can be challenging, considering the peculiarity of its nature and structure. The management strategies that are used as guidelines of response to cyber incidents can be of a different approach: the focus can be on the fool proofing phase before the attack, on the action needed during the extent of the attack or on the assessment and recovery after the incident. Critical energy infrastructures are subjects to extreme interconnectivity, as usually more than one type is implemented to sustain one country's energy flow. The interconnectivity, while being an effective instrument for more reliable energy production, can mean that damaging one source can bring heavy consequences to other infrastructures that are on its receiving end.

The following paper will attempt to analyze various cyber incident response management strategies. The majority of the documents are for governmental use, hence there will be a general approach to CI. However, the focus will be on Critical Energy Infrastructures (CEI), as their importance and functioning affect immensely the other types of CI. The goal of the paper is to highlight the procedures that are more suitable to be applied to CEI in the frameworks, and then propose a possible cybersecurity model for CEIs. The analysis will be conducted by comparing the procedures and by choosing the more suitable for CEI, not focusing on technological aspect but on the framework regarding management strategies. The framework were chosen due to the number of organization that implemented it, theoretical approaches and date of publication.

2. Analysis of cyber incidents' management strategies

2.1. NERC Implementation Guidance for CIP-008-6 (2019)

The North American Electric Reliability Corporation (NERC), a not-for-profit international regulatory authority, introduced in January 2019 "Cyber Security – Incident Reporting and Response Planning" for ensuring the functioning of the power grid. The framework is called Reliability Standard CIP-008-6, it proposes the guidelines for reporting and reacting to cyber incidents in the power grid, and it is classified under the OT Standards & Frameworks (NERC 2019). The types of cyber incidents are classified in a color code that progresses from no reportable to urgently reportable, with Green as "non-reportable, events/activity, or determination not made", Yellow as "Cyber Security Incident, reportable determination not made", Orange as "is determined reportable attempt to compromise an Applicable System" and Red as "determined Reportable Cyber Security Incident"

(NERC 2019). To summarize, the response is based on a “reportable\|not reportable” classification, which criteria, however, are chosen by the Registered Entities, meaning the electric company following the procedure. The classification system can be quite valuable for determining the adequate response to different kinds of cyber events, as the emergency level goes up there are different roles that are prepared for the response.

The framework contains an example of the classification of cyber incidents with the NCCIC Cyber Incident Scoring System (NCISS), based on the National Institute of Standards and Technology (NIST) Special Publication 800-61 Rev. 2, Computer Security Incident Handling Guide, which will also be evaluated (CISA 2020). The infrastructure described in the framework is divided into the Corporate Zone and the SCADA zone. The Corporate zone consists of regular corporate assets and is the outer part of the infrastructure, protected by an Electronic Security Perimeter and an Electronic Access Control or Monitoring System (EACMS). The SCADA zone contains the core of the Industrial Control System (ICS) and is protected by other EACMS and a corporate firewall that protects the corporate assets from Internet intrusions. The NCISS aligns with the Cyber Incident Severity Schema (CISS), which has five levels of emergency, which ranges from white (level 0) to black (level 5), and is calculated by observing the preparation, the engagement, the presence and the effect (CISA 2020). Referring to the aforementioned infrastructure model, reportable incidents are attempts to compromise a system identified in the “Applicable Systems”, and hence that is capable to breach from the corporate zone to the SCADA zone (NERC 2019).

In the process of identification, the first management role is the Incident Management Service Desk, which is responsible mainly for incident “ticketing” and “logging” (NERC 2019), meaning that it is responsible to assess the degree of the incident and, if necessary to assign the procedure to the responsible entity. The Incident Management Coordinator is responsible for the coordination of the activities and is consulted if the cyber event escalates, assisting the Service Desk to update the incident tickets with status and to communicate with the interested users. The E-ISAC/ NCCIC Reporting Coordinator is responsible for the coordination of regulatory reporting activities related to E-ISAC (Electricity Information Sharing and Analysis Center) and the NCCIC regulatory framework (NERC 2019). Finally, the Investigating Subject Matter Experts are responsible for the technical details related to the investigation of the incident. An appendix of the framework offers both the instructions to fill a Cyber Security Incident Reporting Form, which is a part of a correct approach, as it institutionalizes the reporting of the incidents and it makes it easier to classify the incident and having a faster response to it.

Overall, the NERC framework relies on the NIST guidelines; the introduction of the classification of Cyber Incidents based on a risk-assessment method could be a valid technique to develop in a general model. However, if the model will be referred to every type of CEI, it should consider more general elements of the infrastructure, as it may vary. The separation of the management role according to the incident’s gravity is as well a good approach to the response to cyber incidents and should be included in the general guidelines for CEI. Registered Entities decide each of their criteria of classification of reportable\|non reportable incidents, meaning that for CEI the approach should try to consider, for what is possible, a common set of emergency criteria. The management approach that emerges from this framework takes into consideration the risk-assessment method for the classification of Cyber Incidents and the “Lesson Learned” method, but the damage of a cyber-attack to CEI could not be quantifiable only in financial terms, but also in terms of loss of human lives and physical disruption. For this reason, the “Lesson Learned” approach is not recommended.

2.2. Computer Security Incident Handling Guide Special Publication 800-61 Revision 2 (2012)

The National Institute of Standards and Technology (NIST) offers standards and guidelines valid for governmental (US) Federal agencies, but not for national security systems (Cichonski 2012). The framework

comprehends and covers the procedures necessary for the implementation of an appropriate cybersecurity strategy for Computer Systems. Since the framework is widely used for Federal Agencies, it does not refer in particular to potential physical disruption or human life loss, and it may be in some ways unprepared to “newer” hacking strategies since it is from 2012. It is classified under IT Standards & Frameworks, and it offers a detailed procedure focused on incident response capabilities and incident handling. The reason for the chosen approach is due to the IT approach, which is related to governmental agencies and businesses, for which a cyber-attack could hardly resolve in the physical disruption.

In the framework, an extensive part is dedicated to the organization of a Computer Security Incident Response Capability (CSIRC) and offers a variety of team models. The major difference made in the framework is the division of the models between “large” or “small” enterprises, which confirms the dedicated approach to businesses and IT environments. While for small organizations it is advised a Central Incident Response Team, for larger agencies and organizations with “major computing resources at distant locations”, Distributed Incident Response Teams are advised, meaning that all the groups should be coordinated by a single entity (Cichonski 2012). For both models, there should be a Coordinating Team, which provides advice to the other teams without having authority over them. Concerning the staffing of the Incident Response Teams, the agencies can pick one of three options; the first one is to form the team from employees, to be Partially Outsourced, or to be Fully Outsourced.

The NIST guidelines then proceed to describe the stages of the incident response process: it is divided into four major phases, Preparation, Detection & Analysis, Containment Eradication and Recovery, and Post-Incident Activity. In the phase of Preparation, the general procedure is for the response team to have a so-called jump kit at all times and ready to use. A jump kit is a portable case that contains materials that could be useful during the investigation, and that in the framework is divided into Communications and Facilities, Hardware and Software and Resources. It is also advised the presence of laptops and of spare workstations, servers, networking equipment that be used for restoration and tracing malware. Important tools that are also worth mentioning are cryptographic hashes of critical files: the US possesses a National Software Reference Library (NSRL), which maintains the record of hashes of various files that can be downloaded at any time for restoration and backup.

The Detection & Analysis phase provides a thorough description of the possible types of attack vectors that an organization can face during a cybersecurity attack, but most importantly, it offers an interesting approach in the classification of the intensity of the various cyber-attacks to the organizations. After the recommendations and the analysis of the incident, it is offered a system providing an Incident Prioritization system, which refers to three main categories, Functional Impact of the Incident, Information impact of the Incident and Recoverability from the Incident. It has four degrees of impact, none, when it does not affect the organization’s ability to provide all services to all users, low, medium and high, where the organization is no longer able to provide some critical services to any users (Cichonski, 2012). The model is extremely detailed and could be useful for Critical Energy Infrastructure as well, but as the focus is more on IT environments, it puts focus on the information loss and not in terms of physical damage.

In the Containment Eradication & Recovery, NIST proposes that organizations should separate containment strategies that change for every major incident type, offering various criteria for determining the appropriate strategy. The last phase of Post-incident Activity focuses almost entirely on the “Lesson Learned” approach, by describing the structure of the meeting and the management of the incident data metrics (Cichonski, 2012). In addition to further recommendations, the framework offers an Incident Handling Checklist, as well as various scenarios in which are tested the responses to different types of threats. The presence of the latter is fundamental for adequate incident handling guidelines, and should, along with Critical Infrastructure specifications, be present in a hypothetical model.

Overall, the NIST Cyber Incident Handling Guide offers a thoroughly detailed framework that considers an in-depth analysis of the phases necessary to build an effective response strategy for organizations belonging to IT environments. While many elements mentioned in the Guide could be effectively applied to the evaluation and strategy dedicated to Critical Energy Infrastructures, the guidelines propose the loss or theft of information as the worst possible scenario. For what concerns CEI, as aforementioned, cyber-attacks could resolve not only loss of money or information but with physical disruption and loss of human life. As well, the element of interdependency can represent a challenge for the formation of an adequate framework, a model framework for CEI should contain information loss prevention but should not stop the analysis to IT environment strategies.

2.3. Framework for Improving Critical Infrastructure Cybersecurity (2018)

The NIST: Framework for Improving Critical Infrastructure Cybersecurity is classified under the OT Standards & Frameworks, and relies upon eight public workshops, multiple Requests for Comment or Information, and thousands of direct interactions with international stakeholders (NIST 2018). The document is defined as “technology neutral” as being constantly updated with global guidelines and standards for the technical aspects while maintaining its core. The common taxonomy of the framework for the organizations is to form a “Profile”, which considers the current cybersecurity posture and the target state for cybersecurity and assesses the progress of the organization towards the goal (NIST 2018). Ultimately, the framework has a complementary role to other, previously established, cybersecurity programs in the organization and it is used solely to enhance the cybersecurity of Critical Infrastructures.

The framework is divided into three main parts: Framework Core, Framework Implementation Tiers and Framework Profile. The Core provides an interesting approach to the improvement of cybersecurity strategies: the goal is to provide an adequate method for managing and responding to cyber risks. The approach then is different from the previously seen frameworks, as it is not a set of actions to follow and check: this depends on the fact that the nature of the framework is not to be comprehensive but complementary; hence, the evaluation will be different. The core elements consist of Function, Categories, Subcategories and Informative References. The Functions serve in organizing the cybersecurity activities in phases in succession, Identify, Protect, Detect, Respond, and Recover (NIST 2018), while still aligning with existing methodologies in the organization. Each Function is divided into Categories, into groups of cybersecurity outcomes closely tied to programmatic needs and particular activities, which are again divided in Subcategories, which divide each Category into specific outcomes of technical and/or management activities (NIST 2018).

The core elements are defined as well, though it is specified that the goal is not to provide a serial path but to have general guidelines performed concurrently and continuously to address a dynamic security risk. The Identify function is defined as “Develop an organizational understanding to manage cybersecurity risk to systems, people, assets, data, and capabilities, which is fundamental for prioritizing the necessary improvement strategies. To Protect is to “Develop and implement appropriate safeguards to ensure delivery of critical services”, a function that supports the ability to limit and contain the impact of a cyber event. To Respond is to “Develop and implement appropriate activities to take action regarding a detected cybersecurity incident”, while to Recover is to “Develop and implement appropriate activities to maintain plans for resilience and to restore any capabilities or services that were impaired due to a cybersecurity incident.” (NIST 2018).

The second part of the framework provides clarification on the use of Tiers in the framework: according to the definition offered by the framework, they describe a degree on sophistication in the already existing cybersecurity risk management practices of an organization. They are useful for determining the necessary modification of the cybersecurity strategy practices (NIST 2018). The Tiers are divided into four levels, Partial, Risk Informed, Repeatable and Adaptive. The method can be applied to the phases of the plan, design, build\buy, deploy, operate

and commission, and can be at any moment modified and updated (NIST 2018). It is worth mentioning that the frameworks provide an interesting approach that is focused on the specificities of Critical Infrastructures, by mentioning the importance of ensuring secure and constant communication among stakeholders in the supply chain, even though for CI they are especially complex and require multiple levels of organization (NIST 2018).

Overall, the NIST framework provides an interesting approach for the implementation of cybersecurity tactics compared to the previously analyzed documents. The peculiarity of its structure, however, provides it to be the main reference in the construction of an adequate framework. Some elements might be useful in developing a framework for CEI, as the approach is more complementary and takes account of the interconnectivity problem, though it does not offer a valid solution to it. Additionally, the implementation of Tiers as a determination of necessary cybersecurity improvements could be useful for CEI as an additional tool for determining the necessary implementation to improve their security.

2.4. Centre for Cyber Security Belgium: Cyber Security Incident Management Guide (2015)

The provided Cyber Incident Guide is offered as a National Cybersecurity guideline for the country of Belgium, developed by the Cyber Security Coalition to raise awareness among both citizens and organizations. The framework provides general guidelines for drafting a cybersecurity incident response plan and an incident response team. The first phase consists of Identify your assets and potential threat, so categorize and document the “vital” elements of the organization’s structure to determine what to protect. The methodology of documentation is furtherly offered in the documents and proposes to determine a priority system for recovery, meaning to determine the order in which the systems will be reestablished (Darville 2015).

A very detailed part of the framework is dedicated to the creation of a Cyber Security Incident Response Team. For every role, are specified as well its responsibilities and necessary skills. The most important position is covered by the Cyber Security Incident Manager, whose responsibility is to keep the management of the cyber incident under control from the beginning to the end. The Management has the ultimate responsibility of deciding on how to proceed with the right resources at the moment of the cyber incident, so decide for example whether the internet connection should be shut down and when (Darville 2015). The ICT technical support staff has an eminent role in the team as well. The document then reserves an extensive part about the development of an effective contact list, which is, however, more targeted to SME and common businesses rather than CEI. A division is made among different stakeholders in internal (senior management, business managers, employees), external (media, customers, suppliers, and others) and official. The latter type of stakeholders is referred to with Belgian national organizations, such as the Privacy Commission and Cert.be, which are going to be later analyzed (Darville 2015).

The second part of the guide is dedicated to the detection and identification of potential cybersecurity incidents. The recommendations for preventing a cyber-attack are worth mentioning the protection of endpoint devices and the control of the logs to monitor unusual activity (Darville 2015). The third part is devoted instead to the strategies of containment of cybersecurity incidents, but there are some specificities on the SMEs approach. For example, the document proposes a “common strategic decision” that every organization potentially faces during a cyber-attack: the choice between disconnecting the system immediately to recover more quickly or to take the time to observe and collect the necessary evidence. Differently from the other analyzed frameworks, the guide does not offer a classification based on the level of intensity of the emergency. A further part is dedicated to detail on the communication during a cybersecurity incident. As aforementioned, the authorities that are mentioned are almost exclusively from Belgium. The framework ultimately offers an incident follow up and closure in a “lesson learned” approach which provides an evaluation of lesson learned and future actions, along with incident tracking and reporting. It is worth mentioning that in the Appendix is provided a table with the most common incident

types and how to neutralize them, a feature that could be useful for CEI employees: the most common types of incidents are briefly explained, along with a direction on the possible handling of the incident.

Overall the guide offers an exhaustive explanation of the appropriate procedures to follow in case of a cyber incident, although mostly focused on the procedures in SMEs and commercial businesses. The approach could be useful for CEI for some elements, such as the accurate description of the Incident Response Team. The division of the roles based on the responsibility is a good approach for a possible CEI model, as it would be easier for the business to raise awareness among the workers. Also, the appendix providing the solution for the most common incident could be really useful if available to all the workers. The excessive focus on the communication to external stakeholders, while being useful for SMEs, is not a CEI priority.

2.5. Security PHA Review for Consequence-Based Cybersecurity (2019)

The last text to be analyzed will be the Security PHA Review for Consequence-Based Cybersecurity written in 2019, which represents an exception compared to the other documents taken into consideration. While not being implemented on a national level, the framework offers a uniquely innovative approach for the response to cyber incidents in Industrial Control Systems (ICS). The manual developed by the International Society of Automation (ISA) concerns the OT environment and has an overall technical approach to the improvement of cybersecurity. It is usually implemented in wet process industries (chemical, oil refining, and petrochemical), and it proposes a different approach to the assessment of an industry's cybersecurity level. The proposed method is the PHA method, or "Possible Hazard Scenario" method, which consists in the evaluation of the cybersecurity level based not on the safeguards that should be used but on what accident scenario the safeguard presents against (Marszal 2019). The basic methodology described uses the following steps: generate potential scenarios and brainstorm about the possible outcomes of the scenario. With this method, every safeguard is tested in the situation in which assumingly it does not operate (Marszal 2019). Then all the scenarios are ordered by the likelihood of it happening, and finally, there is a recommendation on how to improve the overall situation. The scenarios are then implemented according to their security level, a qualitative measure that expresses the amount of mitigation of cyberattack risk necessary (Marszal 2019).

An interesting approach is furthermore used in this document, as the scenarios are classified as "hackable" or "non-hackable". If the action needs a virtual command for it to be pursued, it is hackable, while if the action needed is manual it is non-hackable. Hence, if for every virtual action performed by the ICS it will be implemented a physical, non-hackable safeguard, the risk of cyber-attack would be highly diminished (Marszal 2019). As aforementioned, the documents present a big part of technical aspects concerning the types of non-hackable safeguards applicable to the ICS. However, it will not be considered in-depth for the analysis. Even though the system is applied to a relatively restricted field of ICS, the brainstorming approach would be ideal for CEI, as it is focused on prevention rather than a "lesson learned" approach. As the previous analysis tried to identify and analyze the various approached of the preexisting frameworks, the following part will summarize the elements that were found useful for a hypothetical framework.

3. Recommendations for a possible framework and conclusions

The article proposed to develop a possible solution to the lack of regulation of CEI by analyzing various frameworks that offered a different approach. While not being able to develop a precise degree of accuracy or to classify the framework for "best application", it is, however, possible to highlight the best solutions to the issues in CEI. To develop an effective cybersecurity model, the structure that will be taken into consideration will be the one described by Limba & Pleta (Limba et al. 2017). The dimensions of a good cybersecurity model are firstly

legal regulation, meaning that there are legal proceedings and requirements about cybersecurity, good governance, which means that the main aims of cybersecurity need to be understood (including the fact that some risks could never be excluded) (Limba et al. 2017). However, the most important dimensions taken into the analysis will be risk management, security culture, as the organization is “as vulnerable as the people working there”, technology management and incident management (Limba et al. 2017).

As mentioned before, one problem that is usually part of the CEI cyber-attacks is the lack of awareness or training of the employees. Following the model, the dimension taken into consideration is the security culture. In the case of a cyber incident, the document that better addressed the awareness issue is the Cyber Security Incident Management Guide. In a possible framework for CEI, the training part of the document should use the same approach of the Guide, as it offers a general tone that can be understood by the employees. Along with the distribution of the appendix of the most common cyber incidents and how to resolve them, the document as well offers a clarification on the formation of the Cyber Incident Response Team (Darville 2015) based on responsibility. The latter explains the roles necessary for each organization to form an adequate Cyber Incident Response Team, clarifying the tasks that each part of the team should fulfill. For these reasons, the document’s approach to awareness and training is the best.

For what concerns the risk management, it is described as the ability to properly identify risks and ensuring that they are being taken care of by specialists (Limba et al. 2017). The document that provided the most adequate guidelines for a hypothetical CEI framework is the NERC Implementation Guidance for CIP-008-6. As mentioned in the previous chapter, the framework contains an example of the classification of cyber incidents with the NCCIC Cyber Incident Scoring System (NCISS) (NERC 2019). The classification of possible cyber incidents is done with the intent of dividing different situations by the level of emergency and ensuring a comprehensive response assessment. Additionally, the implementation of a standard form to be filled for it to be classified is a method that could be useful in emergencies. However, in the NERC document, the criteria of emergencies were depending on the Registered Entity, which could not be the best approach for CEI, as it would need more general criteria that are applicable to every type of CEI.

The incident management dimension of a good possible cybersecurity strategy for CEI could follow the NIST Computer Security Incident Handling Guide approach. The framework offers an in-depth analysis of the procedures to implement before a cyber incident occurs. The development of a jump kit (Cichonski 2012) could be extremely useful if implemented in the CEI as a habit, so the time of response would be considerably lower. Moreover, the separate containment strategies that change for every major incident type are another element that could improve greatly the security level during a cyber-incident. Also using containment strategies, besides having the advantages of being tailored for every CEI, allows the response patterns to be classified according to a prioritization system. This could be effective if there would be a separate classification for cyber incidents and emergency levels, which would be general for every CEI and then modified with in-depth situations and framework for every type of CEI.

Lastly, for technology management, the most interesting approach was offered by the Security PHA Review for Consequence-Based Cybersecurity, as it offered the knowledge about each component that is controlled by IT can be vulnerable (Limba et al. 2017). As mentioned in the previous analysis, the scenario-based approach is the best one that can thoroughly analyze every single component of an ICS system. The approach should be found extremely useful for CEI, as well as the approach would offer a complete and comprehensive view on the likelihood of the various components to be attacked.

A possible classification of Cyber Incidents could be the one used in the NERC Implementation Guidance for CIP-008-6 and the NIST Special Publication 800-61 Rev. 2, Computer Security Incident Handling Guide, known as CISA Cyber Incident Scoring System. Used by the US government agencies, the system includes weighted

arithmetic mean to produce a score from zero to 100 (CISA 2020) based on different categories. Each category has a weight, and each response score is multiplied by the category weight. The categories are Functional Impact, Observed Activity, Location of Observed Activity, Actor Characterization, Information Impact, Recoverability, Cross-Sector Dependency, and Potential Impact (CISA 2020). After the scoring of an incident, a priority level is assigned. The levels are Emergency (Black), Severe (Red), High (Orange), Medium (Yellow), Low (Green), Baseline. An interesting feature in the evaluation of the incident promoted by this system is that the final evaluation takes into account “Multiple Connected Incidents”. The latter is, as aforementioned, a common issue in the evaluation of the emergency level of an attack against CEIs, making it the most accurate system currently available. Additionally, the Cyber Security Incident Management Guide mentions the Cert.be (federal Cyber Emergency Response Team) as an organization that supports and helps targeted organizations. The development of a similar organization is already present in countries like the US and Canada but could help if implemented on an intranational level. NATO has developed the NATO Computer Incident Response Capability (NCIRC) in Belgium but is still far from being used frequently by organizations/government in distress (NATO 2020).

In conclusion, the analysis presented in this paper offers interesting insights regarding the development of a management model for CEIs. Firstly, none of the frameworks that were analyzed were considered comprehensively adequate, although each of the documents presented useful elements of analysis. The final structure of the hypothetical model gathers various theoretical approaches which, if considered part of a larger cyber security strategy model for CEIs, are more than adequate for the goal of the paper. The analysis of this paper demonstrated that it is possible to develop an effective model valid for all CEIs, however it is necessary to activate effective intranational organizations, available 24/7, which can offer support to organizations under cyber attacks.

References

- Darville C. M. D. (2015). *Cyber Security Incident Management Guide*. (C. f. Belgium, Ed.) Belgium: Cyber Security Coalition. Retrieved from <https://b-ok.cc/book/3704644/d3244d>
- CISA. (2020, February). *CISA Cyber Incident Scoring System*. Retrieved from Cybersecurity and Infrastructure Security Agency (CISA): <https://www.us-cert.gov/CISA-Cyber-Incident-Scoring-System>
- CISA. (2020). *Cyber Incident Severity Schema*. USA: Cybersecurity and Infrastructure Security Agency (CISA). Retrieved from <https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Cyber%2BIncident%2BSeverity%2BSchema.pdf>
- Marszal, J. M. (2019). *Security PHA Review for Consequence-Based Cybersecurity*. USA: International Society of Automation (ISA). <https://open.spotify.com/track/3MRWlUuhlyA4ClGIFWhPlm>
- Limba, T., Plêta, T., Agafonov, K., & Damkus, M. (2017). Cyber security management model for critical infrastructure. *Entrepreneurship and Sustainability Issues*, 4(4), 559-573. [http://dx.doi.org/10.9770/jesi.2017.4.4\(12\)](http://dx.doi.org/10.9770/jesi.2017.4.4(12))
- Beazner M., P. R. (2017). *CSS Cyber Defence Hotspot Analysis: Stuxnet*. Zurich: Center for Security Studies (CSS), ETH Zurich. Retrieved from <https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/Cyber-Reports-2017-04.pdf>

Bhayani M., M. P. (2016). Internet of Things (IoT): In a Way of Smart World. In B. Y. Satapathy S., *Proceedings of the International Congress on Information and Communication Technology. Advances in Intelligent Systems and Computing* (Vol. 438). Singapore: Springer.

NATO. (2020, March 17). *Cyber Defence*. Retrieved from NATO: https://www.nato.int/cps/en/natohq/topics_78170.htm

NERC. (2019). *Cyber Security – Incident Reporting and Response Planning: Implementation Guidance for CIP-008-6*. North American Electric Reliability Corporation. Retrieved from [www.nerc.com/pa/comp/Reliability Standard Audits Worksheets DL/RSAW CIP-008-5 2015_v1.docx](http://www.nerc.com/pa/comp/Reliability%20Standard%20Audits%20Worksheets%20DL/RSAW%20CIP-008-5%202015_v1.docx)

NIST. (2018). *Framework for Improving Critical Infrastructure Cybersecurity*. Washington: National Institute of Standards and Technology. [doi:https://doi.org/10.6028/NIST.CSWP.04162018](https://doi.org/10.6028/NIST.CSWP.04162018)

Cichonski P., T. M. (2012). *NIST Special Publication 800-61 Revision 2: Computer Security Incident Handling Guide*. Washington: U.S. Department of Commerce. Retrieved 2012, from <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-61r2.pdf>

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EMPIRICAL INTERPRETATION AND MEASUREMENT OF THE PRODUCTIVITY AND EFFICIENCY OF REGIONS: THE CASE OF LATVIA

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Abstract. The main concepts of this study are productivity and efficiency, which are very relevant for Latvia and are reflected both in the latest scientific publications, dissertation researches and analytical reviews of the Latvian ministries and representatives of the European Commission in Latvia, as well as in expert reports published in the press. The objective of this article is empirical interpretation and search of the most corresponding to the terminological background method of measuring of the productivity and efficiency of regions, based on a specific example of the regions of Latvia. The results of the previous authors' research showed that the productivity of region is defined as it's ability to create as many as possible goods or services per unit of time, while the efficiency is the pure economical term that takes into account the amount of the factors of production utilized in the production process. Productivity / efficiency of a region is not only the sum of the productivity / efficiency of economical units functioning in this region, as contains a certain "delta" – synergy effect (for factors of production), agglomeration effect (for enterprises) or concentration effect (for industries). Always economically backward Latvia's region (Latgale region) is not with the lowest productivity calculated by the GDP per 1 km² of a region's territory – by this indicator less successful in Latvia is Vidzeme region. But by the earnings index, calculated taking into account the sectoral structure of employment in a region, exactly the Latgale region as usually occupies the last place in Latvia, and the Riga region – the first one. To calculate the efficiency of Latvia's regions, the authors relied on neoclassical growth models, which take into account the main classical factors of production - labor, land, capital. By the efficiency in Latvia the Riga region leads expectantly, almost 2 times exceeding the efficiency of Pieriga region, and more than 3 times, – the efficiency of Latgale region. But lowest efficiency in Latvia is not in the Latgale region, but once more in Vidzeme region.

Keywords: production process; factors of production; productivity; efficiency; regions; Latvia

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JEL Classifications: C67, D24, E23

1. Introduction

The basic concepts of this study are productivity and efficiency, which are very relevant for Latvia and are reflected in the latest scientific publications (Baranova et al., 2019; Stepinya, 2019; Shteinbuka, 2019), dissertation researches (Krasnopyorovs, 2012) and analytical reviews of ministries of Latvia (Asheradens, 2017;

Bremshmits, 2019) and representatives of the European Commission in Latvia (Zemitis, 2019), as well as in expert reports published in the press (Helmane, 2017; Jekabsone, Skribane, 2018).

The American economist, the author of the “new economic geography” theories, P. Krugman, back in the early 1990s, argued that the only way to improve living standards in the long run is to increase productivity and efficiency (Krugman, 1991a, 1991b, 1997), which is especially relevant for those countries and regions which in their economic development are at the so-called efficiency-driven stage, since it is at this stage that efficiency is the main engine of economical growth (Sala-i-Martin et al., 2016). In Latvia, such regions are Zemgale, Vidzeme, and Latgale (Zeibote, 2018).

An analysis of the scientific literature (Shteinbuka, 2019) made by the authors showed that in Latvia’s economic science there is no systemic understanding of the differences between the terms and concepts “productivity” and “efficiency” as well as their equivalent translation into Russian and Latvian, which, according to the authors, is a serious obstacle to implementation high-quality studies of the problem of increasing productivity and efficiency in the regional economics of Latvia (Korshenkov et al., 2019).

Based on the analysis of linguistic and economic dictionaries (Brockhaus, Efron, 1909; Taube, 1966; Zhdanova, 1995; Zenovich, 1998; Azriliyan, 2002; Egorova, 2014), as well as scientific publications (Drucker, 1977; Daft, 2009; Borisenko, 2014; Stack, 2016), the authors found that productivity is defined as the ability (of a factor of production, of an enterprise, of an industry, of a region) to create as much product as possible per unit of time and is put “at the forefront” – without taking into account the efficiency of the production process – in a planned economy. In its turn, efficiency is a pure economical term that takes into account the amount of resources (factors of production) utilized in the production process (Korshenkov et al., 2019).

In the framework of this article, the authors will try to answer two research questions: 1) how the productivity and efficiency of factors of production, enterprises and industries are interrelated with the productivity and efficiency of regions?

2) how the productivity and efficiency of regions could be measured?

To achieve the objective of this study, all the studied territories — both countries and their inner regions — are taken as regions, since in economic science a region is a territory with a specific economy (Granberg, 2004; Volkov, 2004; Boronenko, 2007), and by this definition a country can also be called a region. Therefore, the objective of this article is empirical interpretation and search of the most corresponding to the terminological background method of measuring of the productivity and efficiency of regions, illustrated by the particular example of the regions of Latvia: Riga, Pieriga (the territory around Riga), Kurzeme, Zemgale, Vidzeme, and Latgale.

2. What is the subject of productivity and efficiency?

In this Section of the article, it is necessary to answer the research question on how the productivity and efficiency of factors of production, enterprises and industries interrelate with the productivity and efficiency of regions. In other words: when we study and measure productivity and efficiency, what is the subject, i.e. “the productivity of what” and “the efficiency of what” we are investigating? Answering this question, the authors will constantly keep in mind that they are primarily interested in the productivity and efficiency of regions, which should also be distinguished from the productivity and efficiency of – as an example – labor as a factor of production (or, for example, capital) in regions, i.e. regional productivity of labor (or, for example, capital) as a factor of production. I. Borisenko in his study of the modern concept of increasing the efficiency of entrepreneurship, concludes that

the productivity and efficiency of a region and the productivity and efficiency of labor (or any other factor of production or their combination) are general and particular, i.e. productivity and efficiency, for example, of labor as a factor of production is a component of the productivity and efficiency of a region (Borisenko, 2014).

Thus, the productivity and efficiency of a region is the result of the “work” of all factors of production available in the region and all enterprises or industries operating in the region, i.e. the result of the functioning of the region’s economy. In its turn, the productivity and efficiency of each individual factor of production – labor, capital, land, information, etc. – will be called already “labor productivity” or “capital efficiency”, or “labor and capital productivity or efficiency” (or any other combination of production factors) in a region, but not the productivity and efficiency of a region. So, the authors agree with I. Borisenko that it is incorrect to similize, for example, “productivity and efficiency of a region” and “labor productivity and efficiency in a region” (Borisenko, 2014), since the first includes not only the productivity and efficiency of labor in a particular region, but also the productivity and efficiency of all other factors of production plus the synergy effect, the importance of which in modern economic science has been recognized and updated in numerous and already classical works of M. Porter (Porter, 1980, 1981, 1985, 1987, 1990, 1991, 1996). Latvian researchers also note that, for example, the contribution of technological progress into increasing productivity and efficiency is greater where there are skilled people with high level of knowledge who are able to both apply new technologies and develop them (Stepinya, 2019), i.e. the synergy effect is manifested when the factor of new technologies is combined with the factor of high-quality human capital. The economic theory of agglomeration – beginning with the classic works of A. Marshall with his famous “industry secrets are in the air” (Marshall, 1890) – emphasizes, in turn, the significance of the agglomeration effect, which is especially manifesting in economic clusters and industrial areas (Boronenko, 2009; Radeva, 2014; Zeibote, 2018). The agglomeration effect is the reason that the productivity and efficiency of regions is not only a simple sum of the productivity and efficiency of enterprises operating in a particular region, but also contains a certain “delta” – a derivative of the degree of agglomeration of enterprises in a region (Ullman, 1958; Fujita et al., 1999; Nechet et al., 2012).

In its turn, the sectoral structure of a region’s economy also has its own “delta” – the effect of the concentration of economic industries in a region, which has been studied just in few number of publications of Latvian economic researchers (Boronenko, Zeibote, 2010; Zeibote, 2018), without “going out” to the specialization of regions, based on the increased concentration of one or another industry (or some industries) in a particular region (Bogetic, Sanogo, 2005). (See Figure 1).

Productivity / efficiency of a region

Synergy effect	Agglomeration effect	Concentration effect
Sum of productivity / efficiency of factors of production of a region	The sum of productivity / efficiency of enterprises of a region	The sum of the productivity / efficiency of industries of a region

Fig. 1. The ratio of productivity / efficiency* of regions and factors of production / enterprises / industries

* The productivity and efficiency of regions in this figure are presented as two parallel processes with the same methodological approach to the ratio of general and particular

Source: created by the authors based on Marshall, 1890; Ullman, 1958; Porter, 1980, 1996; Fujita et al., 1999; Boronenko, 2009; Nechet et al., 2012; Borisenko, 2014; Radeva, 2014; Zeibote, 2018; Stepinya, 2019.

Thus, the productivity / efficiency of regions includes, on the one hand, the sum of the productivity / efficiency of the region's factors of production plus the synergy effect from their interaction, on the other hand, the sum of the productivity / efficiency of the region's enterprises plus the effect from the degree of their agglomeration in a region, and third, the sum of the productivity / efficiency of industries plus the effect from the degree of their concentration in a region – similar to how GDP can be calculated in three ways: by income, expenses and value added (Samuelson, Nordhaus, 2010).

3. How to measure the productivity and efficiency of regions?

Based on the author's systemic analysis of the main terms and concepts of this study (Korshenkov et al., 2019), the productivity of regions is empirically interpreted as the ability of regional economies to create as many products as possible per time unit – output per unit of time, i.e. “do many things” (Stack, 2016), without taking into account the resources used for this. Thus, when measuring the productivity of regions, the proposed tools should include a time indicator (Brockhaus, Efron, 1909; Stack, 2016), but not refer to the quantity of factors of production spent – labor, capital, and others, because the efficiency refers to the amount and costs of the used resources.

Since in the research practice of economic science the unit of time when measuring productivity is traditionally considered an hour, month, quarter, half a year or an year (Borisenko, 2014), in order to analyze how the productivity of regions is measured in economic studies, it is necessary to collect all possible measuring tools, which show how many goods and services are produced in a region for at least at one of the aforementioned units of time. But here there is one more problem – the regions differ in area and in the number of population, therefore it is also necessary to understand how we will compare the productivity of regions with each other, as well as the performance of the same region in dynamics, i.e. in relation to itself.

The productivity of regions in the scientific literature is usually measured using gross domestic product (GDP), i.e. the total cost of goods and services produced per year per capita (which takes into account the difference between regions in terms of population) in a given region (Barro, Sala-i-Martin, 1992, 2004; H.M. Treasury, 2001; Rice, Venables, 2004a, 2004b). Although the authors, following many scientific studies, are inclined to consider GDP per capita as an indicator of economic performance of regions (Rice, Venables, 2004a, 2004b; New Zealand Institute of Economic Research, 2014; Simpson, 2014; Stankevics, 2014; Stankevics et al., 2014; Boronenko et al., 2014), but not an indicator of its productivity, since not every “per capita” is involved in the production process, but each of them consumes its results, therefore, the GDP per capita indicator is important for measuring the economic situation in a region.

In many economic studies, productivity of regions is measured using GDP per working hour (Evans, Siegel, 1942; Asheradens, 2017), GDP per worker (which can already be attributed to the measurement of efficiency) (Abel et al., 2010; Baranova et al., 2019) or GDP per square kilometer of territory (which takes into account the difference between regions in terms of area) (International Monetary Fund, 2019). R. Rice and A. Venables suggest to use also the earnings index as a tool of measuring the productivity of regions, calculated taking into account the sectoral structure of employment in a region (Rice, Venables, 2004a, 2004b). The Central Statistical Bureau of Latvia does not have information about GDP per working hour, in turn, GDP per capita or per employee, as mentioned above, is not suitable for measuring productivity of regions – thus, for practical implementation of study, the object of which are the regions of Latvia, the authors use the indicators that are presented in the Table 1.

Table 1. Values of indicators suitable for measuring productivity of Latvia's regions, 2016*

Regions of Latvia	GDP per 1 km ² of territory (in current prices), thousands EUR	Earnings index ** (taking into account the sectoral structure of employment)
Riga region	44407.4	9.54
Pieriga region	376.8	8.32
Vidzeme region	106.9	6.98
Kurzeme region	173.7	7.21
Zemgale region	178.0	7.33
Latgale region	122.4	5.91
LATVIA as a whole	387.7	8.82

* the last year for which, at the time of writing, the Latvian official statistics had data on GDP in the regions of Latvia

** calculated by adding the average monthly gross earnings in various sectors of the region's economy, multiplied by the share of employment in these sectors (see Table 6), followed by dividing this amount by 100

Source: calculated by the authors according to the Central Statistical Bureau of Latvia, 2019a, 2019b.

The authors believe that the annual GDP per 1 km² of the region's territory and the earnings index in the region are those indicators that empirically characterize and can serve to measure the productivity of regions. It is interesting that in relation to the regions of Latvia, Latgale region, which is traditionally lagging behind in economic indicators, is not the lowest productive in terms of GDP per 1 km² of territory – according to this indicator, Vidzeme region is the most disadvantageous in Latvia.

The Table 2 data on the area of the regions of Latvia and the population density give a reason to assume – and this is confirmed by the results of the correlation analysis – that the level of productivity of regions depends very much on these indicators: the region's productivity is higher, if it's territory is smaller and the higher the density population in this territory (see Table 2), which, in turn, confirms the authors' thesis that the efficiency of regions include the effects of synergy, agglomeration and concentration (see Figure 1) and these effects are most noticeable in small regions with a relatively high population density.

Table 2. GDP per 1 km² of the territory of the regions of Latvia and its dependence on the area and population density in these regions, 2016

Regions of Latvia	GDP per 1 km ² of territory (in current prices), thousands EUR	The area of the region, km ²	Population density per 1 km ² of territory, absolute values
Riga region	44407.4	304	2 104
Pieriga region	376.8	10 135	36
Vidzeme region	106.9	15 245	13
Kurzeme region	173.7	13 607	18
Zemgale region	178.0	10 732	22
Latgale region	122.4	14 550	19
LATVIA as a whole	387.7	64 573	30
The interdependence between the productivity of a region and its area / population density, the Pearson's correlation coefficient, n = 6 regions		-0.930, r = 0.000	1.000, r = 0.000

Source: calculated by the authors according to Central Statistical Bureau of Latvia, 2019a, 2019b.

As already noted in the Introduction to this article, productivity was emphasized in a planned economy. It is also believed that the cult of productivity “caused great damage to nature and a lot of suffering to society” (Bevins, 2017). The authors argue that the disproportionate – in comparison to other regions – productivity growth of the relatively small area of the Riga region in Latvia was one of the reasons for the outflow of economic activity from

Riga to Pierīga region, which began in the first decade of the 21st century (Boronenko, 2009; Selivanova-Fyodorova et al., 2019).

As for the second indicator of the productivity of regions identified by the authors basing on the work of P. Rice and A. Venables (Rice, Venables, 2004a, 2004b), the earnings index (calculated taking into account the sectoral structure of employment, see Tables 1 and 3), then the possibility of its application in the study of the Latvian economy is confirmed by the results of a study of the World Economic Forum, namely, data on the indicator “pay and productivity”, which measures the adequacy of earnings to the labor productivity and according to which Latvia in 2016 took 49th place out of 138 with 4.3 points out of 7 possible (World Economic Forum, 2016), and in 2018 - already 46th place out of 140 with 4.4 points (World Economic Forum, 2018) – i.e., we can consider that in Latvia the indicator of earnings matches to the labor productivity. And according to this indicator, it is Latgale region that habitually takes the last place in Latvia, and the Riga region – the first one (see Table 1).

Table 3 presents the data on which the earnings index in the regions of Latvia was calculated and from the analysis of which we can conclude that the problems and challenges related to the productivity of regions of Latvia are not the same in Riga and Pierīga regions in comparison with all other regions of Latvia. So, if in Riga and Pierīga regions (and, as it may seem without additional analysis, in Latvia as a whole), the main “growth point” of productivity of the region is a decrease of employment in the lowest-performing industries of the economy – wholesale and retail trade, car and motorcycle repair; hotel industry and catering services – or, correspondingly, increasing the productivity of these industries (see Table 3), then in other regions of Latvia there is no such a problem – nor in one of the peripheral regions of Latvia is not observed the largest share of people employed in these lowest-performing sectors of economy (see Table 3), but at the same time, the productivity of the peripheral regions themselves, measured using the earnings index, is still lower than in Riga and Pierīga regions (see Table 1). Perhaps the reason is that those industries – namely: transport and storage; information and communication services, which are the most productive in Riga and Pierīga regions (and, as it may again seem without additional analysis, in Latvia as a whole), are not such in all other regions of Latvia (see Table 3).

In calculations of the earnings index these two sectors – transport and storage; information and communication services – are combined by the authors according not for their own free will, but basing on the capabilities of the Latvian official statistics, which have data on the number of people employed in the regions for only these two sectors together, although there are some data on earnings that show, firstly, that the average monthly gross earnings in Latvia in the information and communication services industry is much higher than in the transport and storage industry (but this does not refer to all regions of Latvia), and secondly, this difference is significant only in Riga and Pierīga regions (Central Statistical Bureau of Latvia, 2019c):

- in Latvia as a whole for 2016: transport and storage – 870 EUR;
information and communication services – 1364 EUR;
- in Riga region: transport and storage – 924 EUR;
information and communication services – 1440 EUR;
- in Pierīga region: transport and storage – 869 EUR;
information and communication services – 1255 EUR;
- in Vidzeme region: transport and storage – 690 EUR;
information and communication services – 655 EUR;
- in Kurzeme region: transport and storage – 928 EUR;
information and communication services – 727 EUR;
- in Zemgale region: transport and storage – 620 EUR;
information and communication services – 650 EUR;
- in Latgale region: transport and storage – 551 EUR;
information and communication services – 610 EUR.

Table 3. The average monthly gross earnings in the industries
in relation to the sectoral structure of employment in the regions of Latvia, 2016

Indicators and regions	A	B-E	F	G,I	H,J	K-N	O	P	Q	R-U
Riga region										
Average monthly gross earnings in the industry, EUR	1222	993	884	742	1182	1130	1125	780	874	794
Share of people employed in the industry, % of the total number of employees	0.0	12.9	6.7	20.5	14.9	17.2	6.8	8.4	5.7	6.6
Pieriga region										
Average monthly gross earnings in the industry, EUR	706	870	808	665	1062	957	1050	740	739	709
Share of people employed in the industry, % of the total number of employees	7.0	17.1	8.6	17.9	10.1	11.7	7.0	8.6	5.8	5.2
Vidzeme region										
Average monthly gross earnings in the industry, EUR	740	789	690	521	673	725	836	631	719	607
Share of people employed in the industry, % of the total number of employees	16.7	19.9	6.9	13.2	9.1	6.6	6.0	11.4	6.3	4.1
Kurzeme region										
Average monthly gross earnings in the industry, EUR	664	796	921	518	828	710	849	642	751	583
Share of people employed in the industry, % of the total number of employees	13.1	20.4	9.3	15.5	10.5	7.2	6.1	8.0	4.9	4.8
Zemgale region										
Average monthly gross earnings in the industry, EUR	863	893	731	553	635	656	883	647	715	622
Share of people employed in the industry, % of the total number of employees	12.5	18.7	8.6	16.6	9.4	6.9	8.3	9.2	5.5	4.3
Latgale region										
Average monthly gross earnings in the industry, EUR	608	628	577	437	581	567	712	611	676	513
Share of people employed in the industry, % of the total number of employees	12.8	17.1	4.8	13.1	13.1	6.9	7.9	11.4	8.5	4.3
LATVIA as a whole										
Average monthly gross salary in the industry, euro	820	947	828	677	1117	1078	1071	703	799	722
Share of people employed in the industry, % of the total number of employees	7.7	16.7	7.4	17.3	12.0	11.4	7.0	9.1	6.0	5.3

Source: calculated by the authors according to Central Statistical Bureau of Latvia, 2019c, 2019d.

A – agriculture, forestry and fisheries

B-E – mining and quarrying; manufacturing industry; electricity, gas, heat and air conditioning

F – construction

G, I – wholesale and retail trade, car and motorcycle repair; hotel facilities and catering services

H, J – transport and storage; information and communication services

K-N – financial and insurance services; real estate operations; professional, scientific and technical services; administrative and service activities

O – public administration and protection; compulsory social insurance

P – education

Q – health and social services

R – art, entertainment and leisure; other services

As already noted in the Introduction to this article, efficiency – in contrast to productivity – is related to the result of the production process, i.e. created goods and services, with the amount of factors of production used within the production process. The following Table shows the indicators suitable for measuring efficiency of regions and calculated in relation to the regions of Latvia.

Table 4. Values of indicators suitable for measuring efficiency of regions, in the regions of Latvia, 2016

Factors of production in the region	Regions of Latvia						LATVIA as a whole
	Riga region	Pieriga region	Vidzeme region	Kurzeme region	Zemgale region	Latgale region	
Area (land)	0.005	0.157	0.236	0.211	0.166	0.225	1.000
Number of employed (labor)	0.348	0.198	0.095	0.122	0.116	0.122	1.000
Non-financial investments (capital)	0.595	0.177	0.056	0.065	0.065	0.042	1.000
The relative amount of the main factors of production in the region	0.948	0.532	0.387	0.398	0.347	0.389	3.000
Relative share of GDP produced in the region	0.539	0.153	0.065	0.094	0.076	0.071	1.000
Efficiency of the region	0.57	0.29	0.17	0.24	0.22	0.18	0.33

*calculated by dividing the relative amount of the main factors of production in the region by the relative share of GDP produced in this region; the calculation method implies a mandatory comparison of results between regions, while the efficiency indicator of one region without comparison with others is not informative

Note: Efficiency of the region: The concept of energoinformation is also used in modern economic science, which combines the characteristics of knowledge and the efforts necessary to obtain and use this knowledge efficiently (Kurakov, 2017)

Source: elaborated by the authors according to Central Statistical Bureau of Latvia, 2019a, 2019b, 2019d, 2019e.

To measure the efficiency of Latvia's regions, the authors relied on neoclassical growth models (Solow, 1956; Romer, 1989a, 1989b; Mankiw et al., 1992), which take into account the main classical factors of production – labor, land, capital, although the authors also recognize the importance of other factors of production that have been identified in the modern economic theory – for example, such as entrepreneurial talent (Cusolito, Maloney, 2018; INSEAD et al., 2019), information and knowledge (Berczi, 1981; Neef, 2003; Cocalia, 2015), technology (Brynjolfsson, Hitt, 1995) and others.

The results of the authors' calculations, presented in Table 4, show that Riga region is expected to lead in terms of efficiency in Latvia, being almost 2 times more efficient than Pieriga region, and approximately 3 times more efficient than Latgale region. But – just as in the case of the productivity of regions, measured by GDP per 1 km² of the region's territory, the most low-efficient region in Latvia is not the Latgale, but Vidzeme region again (see Table 4).

As for the main sources of the efficiency of Latvia's regions, in the case of Riga region, the efficiency is characterized by the highest return on capital and labor (1.7/1), concentrated on 5% of the country's territory, and in case of Pieriga region this ratio is already changing towards a slight dominance of labor in relation to capital (in the ratio 1.1 / 1) without a strong territorial concentration (although it is quite possible that an additional study of the territorial distribution of labor and capital in the Pieriga region would show the presence of their territorial agglomeration, intensifying as one approaches Riga). In all other regions of Latvia, a certain – relatively low – level of efficiency is achieved mainly due to the relative vastness of the area in which economical activity is conducted (see Table 4).

Conclusions

1. Based on the analysis of linguistic and economic dictionaries, as well as scientific publications, the authors found that productivity is defined as the ability (of a factor of production, of an enterprise, of an industry, of a region) to create as much product as possible per unit of time and is put “at the forefront” – without taking into account the efficiency of the production process – in a planned economy. In its turn, efficiency is a pure economical term that takes into account the amount of resources (factors of production) utilized in the production process.
2. The productivity / efficiency of a region and the productivity / efficiency of a factor of production, enterprises or industries represent a general and particular concept, while the general is not only a simple sum of the productivity / efficiency of the terms functioning in a particular region, since it also contains a certain “delta” – the synergy effect (for factors of production), the agglomeration effect (for enterprises) or the concentration effect (for industries).
3. The authors argue that the annual GDP per 1 km² of the region’s territory and the earnings index calculated taking into account the sectoral structure of employment in a region are those indicators that empirically characterize and can serve to measure the productivity of regions. The Latgale region of Latvia, traditionally lagging behind in economic indicators, is not the lowest productive in terms of GDP per 1 km² of territory – according to this indicator, Vidzeme region is the most disadvantaged in Latvia. As regards to the earnings index, it is precisely the Latgale region that is ranked last in Latvia by this indicator, and the Riga region is the first.
4. To investigate the efficiency of Latvia’s regions, the authors relied on neoclassical growth models, which take into account the main classical factors of production - labor, land, capital. The results of the authors’ calculations show that Riga region is expected to lead in Latvia in terms of the efficiency, which is almost 2 times higher than the efficiency of Pierīga region, and approximately 3 times higher than the efficiency of Latgale region. However, Latgale region turned out to be the most low-efficient in Latvia, but again – as in the case of productivity measured by the GDP per 1 km² of territory – Vidzeme region is lower-efficient in Latvia.
5. The main sources of the efficiency in Riga region are capital and labor (1.7 / 1 ratio), concentrated on 5% of the territory of Latvia, and in case of Pierīga region this ratio is already changing towards a slight dominance of labor relative to capital – 1.1 / 1, without a strong territorial concentration. In all other regions of Latvia, a certain – relatively low – level of efficiency is achieved mainly due to the relatively large area of their territory.

References

- Abel, J.; Dey, I.; Gabe, T. 2010. Productivity and the density of human capital, Federal Reserve Bank of New York Staff Reports 440. Retrieved from https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr440.pdf
- Asheradens, A. 2017. Produktivitāte Latvijā: tendences, izaicinājumi un politika. [Efficiency in Latvia: tendencies, challenges and policy]. Riga, Latvia: Ministry of Economy of the Republic of Latvia. Retrieved from https://esmaja.lv/sites/default/files/2019-03/a_aseradens_produkтивitate_latvija_-_tendences_izaicinajumi_politika_20170602.pdf
- Azriliyan, A. (Ed.). 2002. Большой экономический словарь. [Big Economic Dictionary]. Moscow, Russia: Institute of the New Economy.

Baranova, D.; Baranovs, O.; Berzinsh, G.; Skribane, I. 2019. Produktivitāte Latvijā: tendences, izaicinājumi, politika [Efficiency in Latvia: tendencies, challenges and policy], in Shteinbuka I. (Ed.). Produktivitātes celšana: tendences un nākotnes izaicinājumi. [Increase of Efficiency: Tendencies and Future Challenges]. Riga, Latvia: Academic Publishing House of the University of Latvia, 43-146.

Barro, R.; Sala-i-Martin, X. 1992. Convergence, Journal of Political Economy 2(100): 223-251. <https://doi.org/10.1086/261816>

Barro, R.; Sala-i-Martin, X. 2004. Economic Growth. 2nd edition. London, UK: MIT Press.

Berzi, A. 1981. Information as a factor of production, Business Economics 1(16): 14-20.

Bevins, V. 2017. Productivity is Dangerous. Retrieved from <https://theoutline.com/post/2595/productivity-is-dangerous>

Bogetic, Z.; Sanogo, I. 2005. Infrastructure, productivity and urban dynamics in Cote d'Ivoire: an empirical analysis and policy implications, Africa Region Working Paper Series 86. Washington, DC: World Bank. Retrieved from <http://documents.worldbank.org/curated/en/107141468247819021/pdf/342470PAPER0CI0Urban0dynamics0AFRwp86.pdf>

Borisenko, I. 2014. Современная концепция повышения производительности предпринимательства [The modern conception of the increasing of entrepreneurship's productivity], Организатор производства [Organizer of Production] 4(63): 5-15.

Boronenko, V. 2007. Klasteru pieeja reģionu attīstībai zināšanu ekonomikas apstākļos. [Cluster Approach for the Development of Regions in Conditions of the Knowledge Economy]. Daugavpils, Latvia: Academic Publishing House "Saule" of the Daugavpils University.

Boronenko, V. 2009. Klasteru loma reģionu konkurētspējas paaugstināšanā. [The Role of Clusters in the Development of Regional Competitiveness]. Doctoral Thesis. Yelgava, Latvia: Latvia University of Agriculture.

Boronenko, V.; Mensikovs, V.; Lavrinenko, O. 2014. The impact of EU accession on the economic performance of the countries' internal (NUTS 3) regions, Journal of Economics and Business (Proceedings of Rijeka Faculty of Economics) 2(32): 313-341.

Boronenko, V.; Zeibote, Z. 2010. Специфика региональной концентрации рабочей силы в экономике Латвии, Social Sciences Bulletin 2(11): 77-96.

Bremsnmits, R. 2019. Reģionālā ekonomika, reģionu un pašvaldību loma tajā. [Regional Economics, the Role of Regions and Municipalities]. Riga, Latvia: Ministry of Environmental Protection and Regional Development of the Republic of Latvia.

Brockhaus, F.; Efron, I. 1909. Малый энциклопедический словарь. [Small Encyclopedic Dictionary]. Saint-Peterbourg, Russia: Brockhaus-Efron.

Brynjolfsson, E.; Hitt, L. 1995. Information technology as a factor of production: the role of differences among firms, Economics of Innovation and New Technology 3: 183-200. <https://doi.org/10.1080/10438599500000002>

Central Statistical Bureau of Latvia. 2019a. Table ISG040: Area, population density and population (at the beginning of the year and average) in regions, cities under state jurisdiction and counties, Statistical database. Retrieved from <https://www.csb.gov.lv/en/statistics/statistics-by-theme/population/number-and-change/tables/isg040/area-population-density-and-population>

Central Statistical Bureau of Latvia. 2019b. Table IKG10_110: Gross domestic product by statistical region and city (at current prices), Statistical database. Retrieved from https://www.csb.gov.lv/en/statistics/statistics-by-theme/economy/gdp/tables/ikg10_110/gross-domestic-product-statistical-region-and-city-current

Central Statistical Bureau of Latvia. 2019c. Table DSG060: Average monthly gross wages and salaries in statistical regions by kind of activity (in euro), Statistical database. Retrieved from <https://www.csb.gov.lv/en/statistics/statistics-by-theme/social-conditions/wages/tables/dsg060/average-monthly-gross-wages-and-salaries>

Central Statistical Bureau of Latvia. 2019d. Table Nbg083: Employed by economic activity (NACE Rev. 2.) and statistical region, Statistical database. Retrieved from <https://www.csb.gov.lv/en/statistics/statistics-by-theme/social-conditions/unemployment/tables/nbg083/employed-economic-activity-nace-rev-2-and>

Central Statistical Bureau of Latvia. 2019e. Table IVG040: Non-financial investment by statistical region (at constant prices of 2017, mln euro), Statistical database. Retrieved from <https://www.csb.gov.lv/en/statistics/statistics-by-theme/economy/investments/tables/ivg040/non-financial-investment-statistical-region-constant>

Cocalia, A. 2015. Knowledge and information – new factors of production in the context of globalization, Ecoforum 1(4): 119-124.

Cusolito, A.; Maloney, W. 2018. Productivity Revisited. Shifting Paradigms in Analysis and Policy.

International Bank for Reconstruction and Development, The World Bank.

<https://doi.org/10.1596/978-1-4648-1334-4>

Daft, R. 2009. Management. 9th edition. Cengage Learning.

Drucker, P. 1977. An Introductory View of Management. New York, USA: Harperis College Press.

Egorova, T. 2014. Словарь иностранных слов современного русского языка. [The Dictionary of Foreign Words in the Modern Russian Language]. Moscow, Russia: Adelant.

Evans, W.; Siegel, I. 1942. The meaning of productivity indexes, Journal of the American Statistical Association 37(217): 103-111.

<https://doi.org/10.1080/01621459.1942.10500619>

Fujita, M.; Krugman, P.; Venables, A. 1999. The Spatial Economy: Cities, Regions, and International Trade. Cambridge, MA, UK: MIT Press.

Granberg, A. 2004. Основы региональной экономики. [Guidelines of Regional Economics]. Moscow, Russia: Publishing House of the Higher School of Economics.

Helmane, I. 2017. Zemā uzņēmumu produktivitāte radīs draudus attīstībai nākotnē. [Low efficiency of enterprises will threat the future development]. LV portal. Retrieved from <https://lvportals.lv/norises/290814-zema-uznemumu-produktivitate-radis-draudus-attistibai-nakotne-2017>

H.M. Treasury. 2001. The Regional Dimension, Productivity in the UK (3). Retrieved from www.hm-treasury.gov.uk/5427.htm

INSEAD (The Business School for the World); the Adecco Group; & Tata Communications. 2019. The Global Talent Competitiveness Index 2019: Entrepreneurial Talent and Global Competitiveness. Lanvin, B.; Monteiro, F. (Eds.). France: Fontainebleau.

International Monetary Fund. 2019. World Economic Outlook 2019: Global Manufacturing Downturn, Rising Trade Barriers. Retrieved from <https://www.imf.org/en/Publications/WEO/Issues/2019/10/01/world-economic-outlook-october-2019>

Jekabsone, S.; Skribane, I. 2018. Produktivitātes slazds. [Trap of Efficiency]. Retrieved from <https://www.db.lv/zinas/produktivitates-slazds-478227>

Korshenkov, E.; Ignatyev S.; Dembovskiy, V. 2019. Теоретическое и методологическое обоснование изучения производительности и продуктивности в региональной экономике [Theoretical and methodological framework of the investigation of productivity and efficiency in the regional economics], Social Sciences Bulletin 2(29): 25-64.

Krasnopyorovs, O. 2012. Latvijas ekonomikas izaugsmi noteicošie faktori. [Factors Determining Growth of Latvian Economy]. Doctoral Thesis. Riga, Latvia: University of Latvia.

Krugman, P. 1991a. Geography and Trade. Cambridge, Massachusetts, London, UK: MIT Press.

Krugman, P. 1991b. Increasing returns and economic geography, Journal of Political Economy 99: 483-499.

<https://doi.org/10.1086/261763>

Krugman, P. 1997. The Age of Diminished Expectations. U.S. Economic Policy in the 1990s. 3rd edition. Cambridge, Massachusetts, London, UK: MIT Press.

Kurakov, L. (Ed.). 2017. Микроэкономика. [Microeconomics]. Moscow, Russia: Publishing House of the IAEF.

Mankiw, G.; Romer, D.; Weil, D. 1992. A contribution to the empirics of economic growth, Quarterly Journal of Economics 2(107): 407-437. <https://doi.org/10.3386/w3541>

Marshall, A. 1890. Principles of Economics. London, UK: Macmillan and Co.

- Nechet, F.; Melo, P.; Graham, D. 2012. Transportation-induced agglomeration effects and productivity of firms in MegaCity Region of Paris Basin, Transportation Research Record Journal of the Transportation Research Board 1(2307): 21-30. <https://doi.org/10.3141/2307-03>
- Neef, D. 2003. The Economic Impact of Knowledge. Boston, USA: Butterworth-Heinemann.
- New Zealand Institute of Economic Research. 2014. Regional economies: shape, performance and drivers, NZIER Public Discussion Paper, Working Paper 2014/03. Retrieved from https://nzier.org.nz/static/media/filer_public/e4/1f/e41f5c81-2d63-4548-8859-2dad5c8e213f/nzier_public_discussion_document_2014-03-regional_economies.pdf
- Radeva, I. 2014. Synergy evaluation in economic clusters: approaches and solutions, International Workshop on Advanced Control and Optimization: Step Ahead - ACOSA, Bankya, Bulgaria. Retrieved from https://www.researchgate.net/publication/324013367_SYNERGY_EVALUATION_IN_ECONOMIC_CLUSTERS_APPROCHES_AND_SOLUTIONS
- Rice, P.; Venables, A. 2004a. Productivity: Understanding Regional Differences. Retrieved from <http://cep.lse.ac.uk/pubs/download/CP162.pdf>
- Rice, P.; Venables, A. 2004b. Spatial determinants of productivity: analysis for the regions of Great Britain, CEP Discussion Paper 642. Retrieved from <http://cep.lse.ac.uk/pubs/download/dp0642.pdf>
- Romer, P. 1989a. Capital accumulation in the theory of long run growth, in Barro, R. (Ed.). Modern Business Cycle Theory. Cambridge, MA: Harvard University Press, 51-127.
- Romer, P. 1989b. Human capital and growth: theory and evidence, NBER Working Paper 3173. Retrieved from <https://www.nber.org/papers/w3173.pdf>
- Sala-i-Martin, X.; Baller, S.; Crotti, R.; Di Battista, A.; Drzeniek, M.; Geiger, T.; Gomez, G.; Marti, G. 2016. Competitiveness agendas to reignite growth: findings from the Global Competitiveness Index, in World Economic Forum. The Global Competitiveness Report 2016–2017. Schwab, K. (Ed.). Geneva: World Economic Forum, 3–50.
- Samuelson, P.; Nordhaus, W. 2010. Economics. 19th edition. McGraw-Hill/Irwin.
- Selivanova-Fyodorova, N.; Komarova, V.; Lonska, J.; Mietule, I. 2019. Differentiation of internal regions in the EU countries, Insights into Regional Development 1(4): 370-384. [https://doi.org/10.9770/ird.2019.1.4\(7\)](https://doi.org/10.9770/ird.2019.1.4(7))
- Shteinbuka, I. (Ed.). 2019. Produktivitātes celšana: tendences un nākotnes izaicinājumi. [Increase of Efficiency: Tendencies and Future Challenges]. Riga, Latvia: Academic Publishing House of the University of Latvia.
- Simpson, S. 2014. Macroeconomics: Economic Performance and Growth. Retrieved from <http://www.investopedia.com/university/macroeconomics/macroeconomics9.asp>
- Solow, R. 1956. A contribution to the theory of economic growth, Quarterly Journal of Economics LXX: 65-94.
- Stack, L. 2016. Doing the Right Things Right: How the Effective Executive Spends Time. Oakland, CA: Berrett-Koehler Publishers.
- Stankevics, A. 2014. Augstākās izglītības loma reģiona veiktspējas paaugstināšanā. [The Role of Higher Education in the Increase of Performance of a Region]. Doctoral Thesis. Daugavpils, Latvia: Daugavpils University.
- Stankevics, A.; Ignatjeva, S.; Mensikovs, V. 2014. Higher education's contribution to economic performance and innovativeness in Latvia: exploratory research, Economic Annals 59(202): 7-41.
- Stepinya, I. 2019. Produktivitāte: kāpēc būtiska Latvijai un Latvijas uzņēmējiem? [Efficiency: why is important for Latvia and Latvia's entrepreneurs?] Shteinbuka I. (Ed.). Produktivitātes celšana: tendences un nākotnes izaicinājumi. [Increase of Efficiency: Tendencies and Future Challenges]. Riga, Latvia: Academic Publishing House of the University of Latvia, 159-172.
- Taube, A. 1966. Русско-английский словарь: около 30 000 слов. [Russian-English Dictionary: about 30 000 words]. 2nd edition. Moscow: Soviet Encyclopedia.

Ullman, E. 1958. Regional development and the geography of concentration, Papers and Proceedings of the Regional Science Association 4: 179-198. <https://doi.org/10.1111/j.14355597.1958.tb01629.x>

Volkov, Y. 2004. Регионоведение. [Regional Studies]. Rostov-on-Don, Russia: FENIKS.

World Economic Forum. 2016. The Global Competitiveness Report 2016–2017. Schwab K. (Ed.). Geneva, Switzerland: World Economic Forum.

World Economic Forum. 2018. The Global Competitiveness Report 2018. Schwab K. (Ed.). Geneva, Switzerland: World Economic Forum.

Zeibote, Z. 2018. Klasteri kā reģionālo politiku un konkurētspēju ietekmējošs faktors. [Clusters as a Factor Influencing Regional Policy and Competitiveness]. Doctoral Thesis. Riga, Latvia: Baltic International Academy.

Zemitis, M. 2019. Eiropas Komisijas ziņojums par Latviju: Produktivitātes reģionālā dimensija. [European Commission's Report about Latvia: Regional Dimension of Efficiency]. Riga, Latvia: European Commission's Council in Latvia.

Zenovich, E. 1998. Словарь иностранных слов и выражений. [The Dictionary of Foreign Words and Phrases]. Moscow: Olymp, Publishing House AST.

Zhdanova, I. (Ed.). 1995. Англо-русский экономический словарь. [English-Russian Economic Dictionary]. Moscow: Russian Language.

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HUMAN RESOURCE MANAGEMENT EFFECTS ON SUSTAINABILITY OF HIGH-TECH COMPANIES: WHAT LITHUANIA AND SOUTH KOREA CAN LEARN FROM EACH OTHER*

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Abstract. The literature on the role of intellectual capital on the development of an economy, industry or business is well established (Carnevale and Smith 2013, Lauzikas and Miliute 2017, Kavurmaci 2018, Koehorst et al. 2019, Schoff and Ito, 2019, Koehorst et al. 2019, and etc.). However, the scarcity of holistic transdisciplinary studies regarding factors/ conditions that are critical to unleash the potential of human resources, such as HR Management innovation (Gonera and Pabst 2019, Lee et al. 2019, and etc.), innovation culture (Isaacs et al. 2019, Halim et al. 2019, Sull et al. 2019, Lauzikas and Mokseckienė 2013, Lauzikas and Miliute 2019a, and etc.), creative leadership (Abdi et al. 2018, Jin et al. 2019, Collett et al. 2019, and etc.), modern technologies (Deloitte 2019, Lee et al., Kim et al. 2019, and etc.), new collaboration forms (Kane et al. 2019, Isaacs and Ancona, 2019, Lauzikas and Miliute 2019b, and etc.), social value-added (Wikhamn 2019, Marwede and Herstatt 2019, and etc.) calls for the untapped research potential in the area of Human Resource Management innovation, based on the development stage and peculiarities of cultural and social norms of an economy. **The purpose** of the present publication is to identify the key drivers of human capital-driven high-tech industries and understand how the Human Resource Management department could help strengthen competitive advantages of high-tech companies in South Korea and Lithuania. **The research question** is what Human Resource Management innovations are necessary to realign the innovation culture with a specific

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cultural/ social context and a corresponding economic/ business development stage in order to improve companies' competitive position in light of digital transformation of the market. **The qualitative semi structured expert interviews** led to assumptions and results which explain how human capital links the culture and innovation and why the percentage of commercialized creative ideas in South Korean companies is higher than in Lithuanian companies. In spite of practical and value adding implications and recommendations to both top management and experts of Governmental policies and programs, a more extensive quantitative research should be provided in the next articles of the same series to feel better the global market trends and understand demographic characteristics that affect the organizational behaviour patterns and HRM decisions.

Keywords: human capital; technologies; HRM; innovation; high-tech; leadership; strategy; sustainability

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1. Introduction

Although it is impossible to imagine the research on Human Resource Management effects on business sustainability without an adequate attention towards HR innovations, in particular with regards to HR strategies, according to Armstrong and Brown (2019), the topic of HRM impacts on sustainable companies' performance has not been dealt with in depth in order to deliver practical and value-adding implications to both research and business. It is in line with Delery and Roumpi (2017) who call this untapped research potential as 'black box' between HRM techniques and competitive advantages of a company; which might lack a more holistic quantifiable and tangible multi-stakeholder perspective in the literature.

The synergy effect among stakeholders, particularly among various-hierarchy level employees, are emphasized by many scholars. For instance, Isaacs and Ancona (2019) refer to collective intelligence which could be facilitated by effective and efficient strategic communication tools that could engage employees and stakeholders and facilitate innovation commercialization process starting from invention or concept development and finishing with entering a niche or shifting to the mainstream market. Formal innovation implementation process with an appointed individual or cross-departmental committee are necessary to track the progress.

Moreover, successful innovation commercialization process should be based on the previous experience and contain a set of rules that are clear at every organizational unit, for each employee and stakeholder along with intellectual property protection tactics and creative leaders appointed. In parallel with innovation commercialization model, a well-established creativity and innovation enhancement system is necessary to gather community, collect ideas, share resources and expertise. Such complex tasks are nowadays feasible thanks to modern technologies, advanced big data and business intelligence tools as well as continuous collaboration initiatives (Isaacs and Ancona, 2019).

According to Clercq and Pereira (2019), individual employees' commitment could be also expressed and enhanced via personal resources and efforts for innovation, particularly in light of rigid routine work and stressful work life conditions. Hammond et al. (2019) also tackle negative effects of innovation behaviour, particularly in stressful situations, such as shrinking revenue and/ or losing competitive edge: at this stage their innovative mind-sets and efforts might not reach their expectations if business or

management processes lack flexibility, proactiveness, and continuous creativity enhancement, while a more strategic and holistic approach towards a challenge is not adopted.

Knowledge and lifelong learning are mentioned as key drivers of effective and efficient management of high-tech companies in the most of literature sources; for instance, according to Tinmaz and Hwa Lee (2019), a sufficient supply and quality of university graduates in terms of their skills and knowledge in 4.0 technologies and processes (Internet of Things (IoT), Artificial Intelligence, Machine Learning, and etc.) might jeopardize development of innovation-driven economies.

The authors emphasize that students might not be ready to perform under extreme market volatility, which requires fast learning, improvisation, big data management and sharp business intelligence competence, along with right attitude and perception towards modern technologies and human resource innovation. Chivot (2019) invites to join the Centre for Data Innovation to discuss the EU's potential of applying AI across various industries: it would be impossible to leverage the value-added of the modern technology without sufficient resources, adequate supply of the talented labour power as well as new policies and/ or programs to support this process.

Unleashing potential of human capital is also accentuated in catching-up economies, such as Nigeria. Having 430 middle managers of four mobile telecommunication companies in Nigeria interrogated, Oladimeji Jamiu Odetunde (2019) introduces a 3-phase innovation model (which includes creativity, innovation and innovation adoption) in order to examine the employees' role in innovation commercialization process. The author came to conclusion that employee creativity directly impacts employee innovation and employee innovation adoption.

While relying on West (2002), Oladimeji Jamiu Odetunde (2019) interprets innovation adoption from both individual and organizational contexts, where employee creativity refers to individual angle while innovation is related to cultural-social context of a company. Although an innovative idea might come from outside of an organization and, thanks to information dissemination and learning process could be adapted (particularly when stakeholders are integrated in innovation commercialization process), the role of employees while generating and commercializing new ideas inside of an organization or efficiently and creatively implementing ideas generated outside a unit should not be diminished. Decision makers should try to adapt optimal innovation culture, which corresponds to cultural-social specificity of a company, because its context affects both individual/ team and organization creativity and innovativeness.

The experts of the Culture is Digital June 2019 Progress Report, prepared by the Department for Digital, Culture, Media and Sport of the UK, go one step deeper and relates innovation culture to big data management (in particular, to data collection and analysis); secondly, describe the situation of digital culture and digital skills and only then overview the progress in innovation processes (including a set of factors, such as the R&D culture and performance, Innovation and Audience Labs, Immersive Fellowships, Production and Technology). Such a holistic innovation ecosystem is backed by relevance of modern technologies. For example, based on this report, AI could inject additional USD 814 billion to the UK economy by 2035, increasing the annual Gross Value-Added from 2.5 to 3.9% via larger content of high-tech in more traditional sectors, such as cultural and creative industries (Department for Digital, Culture, Media and Sport, the UK, 2019). Drawing attention to digital culture calls for new innovative

techniques within the HR Departments, along with enhancement of creativity and competences that are adapted to digital environments.

2. Supply of Human Capital and Modern Technology: Regional Gaps and Competitiveness

The modern technology opens new digitalization opportunities across all industries. For example, a team of experts (Leichteris, Izgoroding, Jakubavičius and others), prepared the Lithuanian Industry Digitisation Roadmap 2019-2030 as part of a project of Ministry of the Economy and Innovation. According to the contributors, although the Lithuanian industry is driven by relatively small, smart and agile factories, its value chains are rather international and backed with a rich supply of talented professionals, high-tech solutions and international strategic partnerships. Continuous digitalization and internationalization of business activities via digital hubs, digital innovations, digital competences as well as corresponding commercial digital infrastructure could help Lithuania strengthen its competitive advantages in the region.

The Deloitte Insights' Report (2019) draws attention to digitalization as a driving force of innovation in European companies. In spite of a strong focus on the dynamics of patents, Deloitte experts recommend to not diminish the role of business models, design, data, organisational innovation and software. Improving competitive advantages in terms of holistic digital technology and innovation, a sustainable and efficient learning system (which corresponds current trends) should be implemented in cooperation with universities. A special attention should be drawn to innovative attitude and culture as well as collaboration among stakeholders via ecosystem of innovation. According to Lee et al. (2019), the strategic direction of innovative business is centred on AI technology, in particular on business model innovation, which can be backed by enhanced AI skills and sustainable learning process.

Internationalisation is a positively contributing factor for high-tech companies from small economies. For instance, based on the 2019 study, prepared by the Lithuanian Laser association, Lithuanian companies continue occupying the largest global market share in scientific lasers sub-industry (1% of the world's laser revenues of €13.8 billion in 2018) and showing industry growth of 5.3% (superior than the global laser market improvement) thanks to international high value-added value chains along with intellectual potential (10% of employees hold PhD).

According to Carnegie Endowment for International Peace (2019), Along with emergence of modern technologies, such as artificial intelligence (AI), big data, fifth-generation telecommunications networking (5G), nanotechnology and biotechnology, robotics, the Internet of Things (IoT), quantum computing, and etc., China emerges as one of new leaders of high-tech innovators, particularly in the areas of manufacturing, digital platforms, apps and other social innovation-related technologies, as well as R&D in the fields of computing and biotechnology. While relying on "Made in China 2025" strategy (New Generation Artificial Intelligence Development Plan), China's performance in intensifying High-Low-tech combination is driven by the purpose to help Beijing possess 70% presence in high-tech manufacturing by 2025, along with the lead of the most-cited 1% of published AI papers by 2025 (currently, China is the world leader in patent applications – 40% global share) (Carnegie Endowment for International Peace, 2019).

According to Word Preview Outlook for 2024, prepared by EvaluatePharma (2019), the performance of biotechnological companies is driven by innovation, when success of approved products indicates the effectiveness of previous strategic decisions that influence the current or future decision-making process, in particular related to the R&D expenditure (nowadays it is driven by machine learning techniques for the discovery and development of new drugs).

Notwithstanding the growing importance of aspects, such as high-tech research, big data and technological intensity, strong environmental, social and demographic pressures might endanger the profitability of high-tech companies due to stronger R&D efforts: it is expected that the increase of annual R&D expenditure from 2018 to 2024 will read 3.0%, while its proportion out of prescription revenue will experience a decrease from 21.6% to 18.0%. This report provides the examples of top R&D projects (such as VX-659/VX-445 + Tezacaftor + Ivacaftor, Upadacitinib, DS-8201) and indicate changes in R&D leaders in terms of expenditure (it is expected that Johnson & Johnson will overtake Roche in 2024).

Although the Word Preview Outlook for 2024 is focused more on effectiveness and efficiency of R&D, decision-making process in terms of R&D priorities and potential success factors call for a well-established innovation culture, along with creativity system, big data management, business intelligence and lifelong learning, which are they key focus areas of innovative HR departments.

While evaluating South Korea's potential in the R&D performance, Kavurmaci (2018) mostly focuses on the supply of educated and skilled human resources, facilitated by national science and technology policies, which affects research efficiency (numbers of patents and articles, ROI from Innovation, technological intensity and economic vs social value-added). Hence, a well-established innovation culture is critical in a country-driven by intellectual capital (such as South Korea and Lithuania), while HRM innovations should liaise culture with strategy as well as support sales, research and international collaboration.

3. Sustainability via Innovative Human Capital Techniques

The dimensions of sustainability and social innovation are continuously gaining momentum across various industries, while interpreting these aspects from the perspective of human resource management or learning process. To better understand the specificity of social value-added, it is worth examining industries that are driven by social innovation, such as Healthcare. Based on NHS review (on behalf of the Secretary of State for Health and Social Care, 2019), intellectual capital, in this case Health and Social care employees, should be better prepared for the digital era. For instance, progress of genomics and digital technologies should encourage employees to perfect their competences in illness prevention, to develop and enhance knowledge of advanced treatments and be ready to offer a patient context-sensitive and holistic care, accompanies by advanced management skills. The report is also centred on more interactive collaboration among various stakeholders, including patient-NHS relationship, engaged community and reshaped attitude of stakeholders via creative leadership and innovation culture. Moreover, digitalization requires from employees adding more trans-disciplinary approach to their profession.

Sustainability and social innovation aspects are also accentuated across various service industries. While examining innovation-customer satisfaction liaison in Swedish hotels, Wikhamn (2019) outlines the role of sustainability of human resource management (HRM) practices. The research reveals the implication, that HR techniques via innovative culture (along with creativity system) make employees and customers more satisfied. Opportunities to enhance employees' skills improve their life quality as well as engage customers through CSR principles; they also improve the social image and popularity of service providers. Based on the literature review of 47 sources, Koster (2019) identifies 3 core axes of innovation in HRM: first of all, it refers to technological process and managerial HR innovation; secondly, innovation impacts on HR are monitored; and finally, it refers to organizational innovation processes. Although the most of the overviewed papers are oriented towards Research and Development, the learning and training also drew a lot of attention in the context of innovative HRM.

While linking innovation and culture dimensions, Whee Lee et al. (2019) focus on the effects of HRM on proactivity and group innovation, based on the survey of Korean companies. The authors admit that the social and cultural context affects the HR efficiency in the context of innovation and proactivity, because in general some nations are driven by a particular cultural characteristic (for instance Korean culture is centred on conformity rather than proactivity). Although Whee Lee et al. (2019) did not differentiate between the impacts of HRM effects on psychological states or proactive behaviours of employees, the study led to implications that it is possible to affect proactiveness via employees' competence, motivation and perception of management, while proactive behaviour may orient employees to organizational goals. Moreover, innovation success could positively contribute to a better social image of a company and employees' satisfaction, while proactive employees lead to higher team creativity and efficiency.

While analysing 495 empirical studies on 516 HR systems, Boon, Hartog and Lepak (2019) try to measure the role of holistic HR systems rather than focusing fragmented practices, particularly from different time and development stage perspectives (it appears that some practices are more important than others). In the longer run, the interrelations between various dimensions of a HR system and its value-added can become more pertinent and clearer; hence, tracking and continuously researching this area could be a worthy pursuit. Both more generic interpretation of Strategic Human Resource Management and specific topics of this field are of significant interest; while efficiency at various organizational levels (Peccei & Van De Voorde, 2019) is interpreted from both a social and economic perspective.

Within 2019 Information Services Group report on challenges and opportunities HR-driven organizations face nowadays (with 271 companies from key geographic regions), the organizational capability to use HR technologies emerges as a vital precondition for sustainability. The capability levels are classified into stages which correspond company's lifecycle, strategy, readiness and its competitive position. For instance, to reach the 4th level of ISG HR Tech Capability Model, the HR department should not only fit strategic directions of a company, but also provide a sufficient access to modern technologies and possess a system to upgrade organizational technological skills. Moreover, this system should be run by integrated business intelligence hub, big data management and strong leadership. According to Information Services Group (2019), in order to become a digital and global player (via improving employee comfort, optimizing OPEX, enhancing innovation and employee engagement) the use and role of HR technologies should be concrete and clear at each strategic development stage; should be continuously monitored by supporting this process with big data, as well

as become a natural part of culture, which is open and flexible to technological changes (particularly AI and robots) and social vulnerabilities.

4. Methodology

Based on Digital Competitiveness Ranking (2019), innovation culture is anchored in 3 foundations: knowledge, technology and future readiness. South Korea is ranked 10th while Lithuania is ranked 30th out of 63 countries. Lithuania and South Korea, in spite of social-cultural differences, economic regional context and size, are both driven by Intellectual capital and high-tech development; thus, these economies could learn a lot from each other. For example, Lithuania occupies the No. 1 spot in terms of digital and technological skills and possesses rather high positions in numbers of female researchers, higher education achievement, enforcing contracts, Communication Technology, agility of companies, use of big data and analytics, cyber security, as well as equilibrium between new opportunities and threats (6st, 11th, 7th, 4th, 4th, 11th, 15th and 7th, respectively), but this Baltic state needs to strengthen its positions in terms of net flow of international students (54th), R&D productivity by publication (55th), Immigration Laws (53rd) and smartphone possession (56st).

In the meantime, South Korea is ranked No.1 in terms of R&D spending, E-Participation and Internet retailing; occupies the 3rd place in terms of higher education achievement, High-tech patent grants, IT & media stock market capitalization, E-Government, world robots distribution; and being positioned the second out of 63 countries in terms of Internet bandwidth speed and enforcing contracts. However, this Asian leader should strengthen its position in terms of female researchers, net flow of international students, International experience, Immigration Laws, banking and financial services (53rd, 50th, 52th, 61st, 54th respectively).

Taking into consideration that both countries have strong positions in IT industry, thanks to relatively high numbers of graduates and proportionally high share of foreign direct investments in this sector, experts' insights and experiences regarding development and usage of digital platforms (selling goods or services) also helps explain the evolution of HR culture in these economies.

In order to leverage the human capital potential and increase the effectiveness and efficiency of the HR Departments' performance via innovation culture (which should affect various competitive advantages of a high-tech company) the experts were asked to fill the matrix of metamorphosis of innovative HRM, while indicating its impacts on various strategic goals. It is obvious, that responses to these questions are rather perception-driven and might be related to the specificity of a company (its size, lifetime, competitive position, and etc.); however, they incorporate the key economy and entrepreneurship development trends, along with cultural and social norms, of the two compared countries. On the other hand, the majority of similar qualitative expert interviews are perception and experience-based, which make the matrix of significant interest.

To better answer the research question what Human Resource Management innovations could help realign the innovation culture with a specific cultural/ social context and a corresponding economic/ business development stage in order to improve companies' competitive position, the in-depth qualitative interviews with top managers (with over 7-year management experience in high-tech) of 6

Lithuanian and 6 South Korean IT companies were conducted; the responses of the Lithuanian and South Korean experts were compared and suggestions how to unleash human capital potential via innovative human resource techniques were provided for corporate professionals and policy makers.

5. Research on Human Resource Strategies within Lithuanian and Korean IT companies

An interesting discovery of the present research is related to the areas to which the creative ideas of South Korean and Lithuanian entrepreneurs are oriented. These areas are also liaised with the main strategic targets of high-tech companies, where culture and innovation could work in harmony to reach business sustainability which can be translated by economic/ social situation of the compared economies. As it could be expected, the entrepreneurs from economically more advanced South Korea, centred their activities on productivity (stated by 4 out of 6 experts). Moreover, all the experts underlined that a sufficient human resource supply must be provided as a key business driver in order to strengthen the competitive advantages of a company.

While acknowledging the significance of human capital on business performance, the interviews outlined that the maturity and social responsibility of companies could be reached (given a sufficient supply of human resources) if culture and innovation properly motivate teams and individuals. Notwithstanding that the role of intellectual capital was mentioned in Lithuanian companies, the Lithuanian entrepreneurs emphasized more the dimensions of Corporate Social Responsibility, creativity enhancement system and social innovation rather than focusing on HR efficiency. It might be related to somewhat bigger socially vulnerable groups in the economy along with the growing demand for high-tech specialists due to rapidly increasing Foreign Direct Investment in high-tech industries, as well as a somewhat more remarkable specialization of Nordic Europe in activities inclined to positive externalities (environmental protection, healthy living, natural/ organic production, and etc.).

Answering the question what new opportunities can modern technologies open up for nascent (starting) businesses, the interviewed entrepreneurs relate the technology effects to the main strategic goals or business efficiency criteria of a company. For instance, the Korean experts emphasized technological impacts while improving and managing productivity by combining big data with AI or finding a new niche to provide a service while developing and maintaining programs for AI capabilities. The Lithuanian experts accentuated HR technologies, AI and Business Intelligence solutions, in parallel with technological solutions to increase social trust, mitigate effects of fear of failure and enhance collaboration activities. Such results show that the interrogated experts feel well the development specificity of their industries and can easily indicate the existing gaps in practices and strategies enhancing the talent development and management.

Based on the Lithuanian high-tech experts, the liaisons between culture and innovation are more related to the HR department (creativity enhancement, talent development, team management, application of modern communication technologies). Such trends correspond to the main development priorities of each economy and industry and shows that high tech experts acknowledge the context of their market and organization and orient the HRM to the development stage of their companies.

The difference in HR strategies between Korean and Lithuanian high-tech firms is remarkable: in the case of South Korea it is related to the R&D culture, while in the case of Lithuania, HR techniques are a

key axis of sustainable and innovative business. The difference could be illustrated by the process how to decide which idea to implement. Korean experts represent companies which already have well established innovation climate: rather than focusing on creativity system development, they focus more on how this creativity system support R&D efficiency and value-added. Profit margins and core efficiency were mentioned by Korean respondents in terms of quantitative KPI-s, while the Baltic experts used more qualitative criteria.

Given a strong organizational structure to support innovation processes in innovation leaders' economies (within interrogated Korean companies there are minimum 2-3 departments and 5-6 people involved in innovative ideas commercialization), the key priority is to use this innovation process and culture while generating the economic and social value-added. As it could be expected the Lithuanian experts had CEO, Marketing or sometimes HR department in charge of creativity or new concepts; however, these innovation processes were rather fragmented without a well-established cross-departmental structure to manage innovation commercialization process.

Intellectual capital is of significant importance for innovation commercialization; however, a sufficient financial input and the quality of the R&D department are also critical, although it is definitely related to the development stage of a company, industry and/ or economy. Two Korean experts argue that it is important to invest not less than 10% out of revenue in R&D, while the other four indicate the values from 20 to 35% or over, compared to up to 10-20% of R&D expenditure, indicated by the Lithuanian experts. This might be related to the assumption that not every high-tech expert understands the complexity of R&D due to lack of knowledge or insufficient business intelligence skills or simply the innovation culture is under the process of development at the present moment and it might take a few years to have the R&D process well-established, effective and efficient. Thus, the role of the HR departments will be crucial to overcome these weaknesses.

Both the Lithuanian and Korean experts agree that a successful company should invest in R&D a relatively high percentage of revenue in order to be edgy and innovative; However, the South Korean experts emphasize more the quality and efficiency of R&D performance and apply more quantitative indicators to measure success of innovation performance. It is interesting to note that the Korean experts demonstrate their knowledge in combining innovation strategy with other strategies (including the business strategy of a company). In order to commercialize innovative ideas, decision makers should understand the specificity of their target market, competitors' skills level, development capability and cost of a company, as well a future strategic outlook: all these elements can be reached only via modern technologies with strong HRM competences and monitoring (which indicate companies' long-term orientation and sustainability).

The Lithuanian experts emphasize a great number of dimensions related to social value-added, such as CSR and shared value economy; however, a clear and strong HR department which could be responsible for measuring and monitoring success of these processes is vacant along with technologies providing shareholders accountability reports or engaging customers in decision-making. This is related to transformation of Lithuanian high-tech industry towards a holistic, sustainable, long-term oriented, accountable and consistent system, where companies tend to learn from their mistakes, while innovation commercialization success is tracked and documented online.

In parallel with a strong R&D performance, accompanied by well-implemented innovation and monitoring functions as well as organizational orientation towards long-term strategic targets, the Korean high-tech specialists admitted that their creativity enhancement system could be graded as 9 out of 9 (stated by experts): their performance is highly encouraged via sustainable learning and creative processes because the enhancement of their skills and creativity are vital to survival and expansion of a company. The Lithuanian experts were more pessimistic regarding creativity encouragement models (the average value of 6), which illustrates the areas of improvement for the HR department.

Notwithstanding a better-developed creativity system in the Korean environment, Lithuanian and Korean high-tech experts were equally involved in innovative projects (twice a year or more frequently). Such result could be related to Lithuania's high rates in terms of intrapreneurship and the efficiency of Korean high-tech creativity systems. It could be also noted that the Korean experts perceive intrapreneurial activities as a logical and formal part of a creativity system, while in the case of Lithuanian IT firms it is more formalized and not integrated into innovation culture of a company.

The Korean experts were not afraid to acknowledge and use their previous employment experience in the development of their own business, since it was related to their current career – they felt more confident to admit that their new career was a spin-off from previous employments. The Lithuanian experts were more intimidated to speak about their intrapreneurship experience, which makes believe that the organizational culture among Lithuanian companies does not fully support these processes; intrapreneurship initiatives are not encouraged and formalized. This implication is related to a set of cultural norms, including social capital dimensions (such as fear of failure, social risk, uncertainty avoidance, risk management, long/ short-term orientation, power distance, transparency, and many others). For instance, if employees are not confident about their future and are afraid to fail, they will prefer to leave the risk management function to their employer. When the self-esteem and creativity encouragement system is not present, entrepreneurs do not shift towards independent entrepreneurship or partial entrepreneurship with 'Win-Win' strategy developed together with a current employer.

When social trust is broken, high-tech experts might feel uncomfortable to use digital hubs involving other stakeholders, in particular, because they do not tolerate their mistakes or failures; it also indicates that monitoring and risk management processes could be fragmented or weakly developed. Thus, innovation culture, which is one of the prerogatives of the HR department, is the most important precondition for intrapreneurship, while vacant intrapreneurship encouragement processes could cause frustration, stress and anxiety among employees and other stakeholders. Such results also explain the reason why the Lithuanian high-tech experts are focusing more on the HR department while linking innovation with culture, contrary to the Koreans who use it as a natural tool to improve efficiency and competitive position in the market.

Representatives of both countries indicated similar technology effects on the development of entrepreneurship activities: first of all, it affected the market share and brand via digitalization, secondly it enabled bigger economic and social value-added via shared value economy or social impacts (such as environmental protection by saving CO2 production or access to education). In the longer run, the entrepreneurship dynamics could show success of linking innovation and culture via technologies, while focusing on a set of factors (% of established businesses, commercialization success of innovation in

terms of revenue from new products or patents, % of commercialized new ideas, growth of revenue and profit, and other competitive advantages).

In terms of main key-words that are related to social contributions, the interrogated experts accentuated the following ones: social impact, shared value economy, social entrepreneurship, environmental protection, healthcare, social innovation, Corporate Social Responsibility, digitalization, robots, and etc., which shows that the high-tech experts are sufficiently knowledgeable in terms of what social value a modern technology could create via innovation of the HR Department.

The Korean tackled new challenges that nowadays technologies could create while shifting employees from a pure executor to intermediary between technologies and people (for instance, AI replaced technical services that were manually developed by skilled workers and led to reduction in the demand for skilled personnel and the provision of high quality technical services), while the Lithuanian experts focused on the development of creativity system which would help employees find their natural talent zone and niche in the future as well as contribute to success of their entrepreneurial ventures.

The Korean experts' experience in digital platforms is further illustrated by their concrete technical examples of technology effects (for instance, building energy management or factory energy management service via AI and big data management techniques or improving renewable energy sub industry via digital platforms). The Lithuanian experts emphasized the increasing importance of digital platforms on business success, but their knowledge and perception were more generic and fragmented. Although both the Lithuanian and Korean experts agreed that they needed to implement or upgrade new technologies at least once per 2 years, the sustainability and accountability towards various stakeholders (including employees, partners and customers) via digital platforms was more accentuated by the Asian respondents: their sustainability description was more specific (for instance, AI-applied technology must be developed through industry-academia or in-house development), monitoring was well established and effective, while culture supported the technological development. Such equilibrium between innovation and culture helped leverage technologies and make business more sustainable (for instance, building energy management technology using AI and big data helped business survive by increasing price competitiveness).

Given a somewhat richer and longer HR experience while developing and enhancing innovation culture in South Korea (where innovation process is well-established, creativity is encouraged and rewarded, the system of innovation is driven by smooth communication via digital hubs, and etc.) it is not surprising that the Korean experts (5 out of 6), more than Lithuanian experts (2 out of 6), indicated communication during the time of change, society engagement, creativity system, and even meeting stakeholders' expectations as competitive advantages which were created thanks to their experience of liaising innovation and culture via the HR Department.

The experts admitted that their efforts to conduct HR innovations helped gather and engage society, create sustainability-centred philosophy and values as well as match employees', customers' and strategic partners' expectations. All these impacts were less emphasized by the Lithuanian experts due to challenges related to fear of failure, uncertainty avoidance, power distance or social trust, as well as a relatively modest experience of implementing a creativity ecosystem with a proper well-developed organizational structure to run continuous and effective innovation processes. Moreover, the South

Korea's advantage in terms of R&D transfer also contributed to experts' emphasis on their strong competitive position while developing and sharing knowledge and using untapped potential of educational organizations.

The experts of both countries admitted that their attempts to link the HR culture with growth (break-even, switching to mainstream) are not always successful, as the whole market (including other peers) face the same threats and pressures (for instance contributions to healthier living, environmental protection, safety and security), which require a higher-level flexibility, monitoring, creativity and efficiency. The economy plays an important role on pricing, quality and profit margins (due to demand factors and business development trends) within high-tech industries of each economy; however, based on research results, the affordability and access to innovative products was a stronger competitive advantage of Lithuanian high-tech companies. Moreover, the similarity of the analysed economies' high-tech industries is also witnessed in terms of social value-added generation and harmony with nature, which shows the maturity and sustainability of both economies (See Image 1).

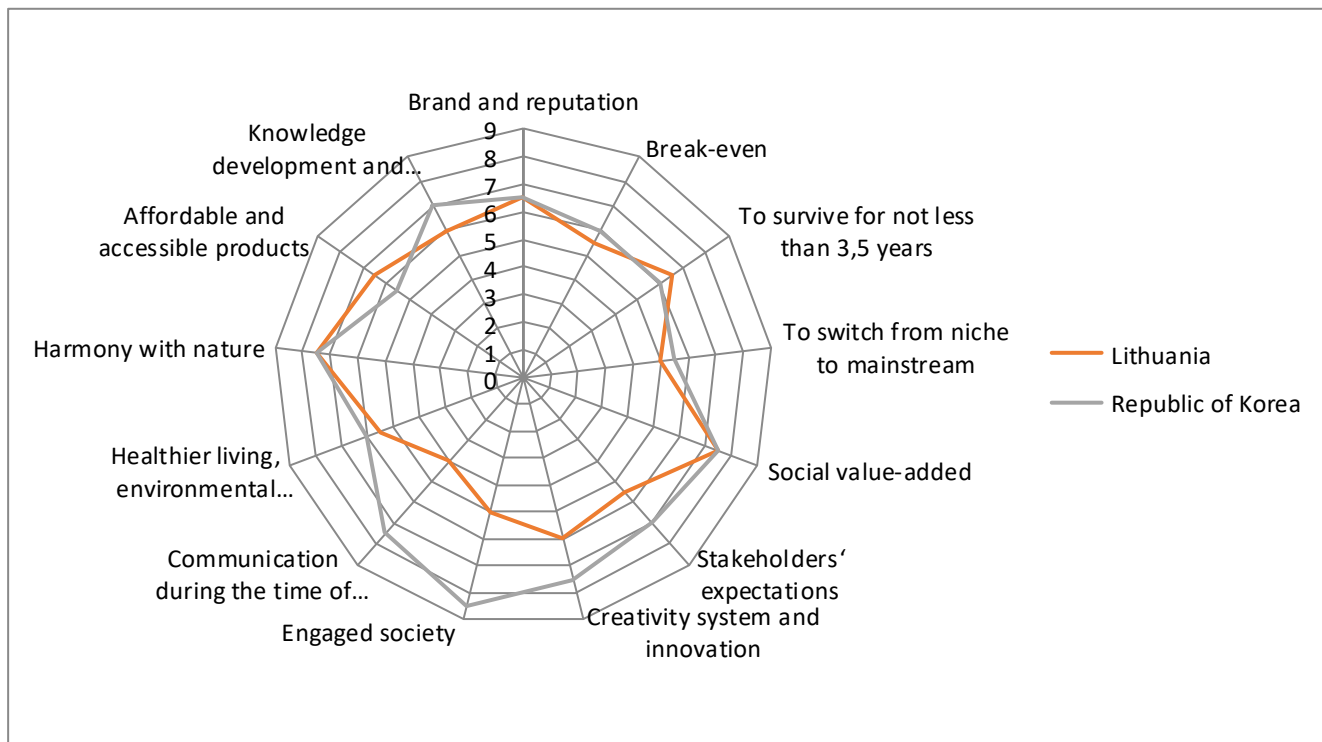


Image 1. Human Resource Management Effects on Sustainability of High-Tech Companies: how important is innovation culture while strengthening competitive advantages of high-tech companies (in the scale of 9; where 9 refers to particularly important, 1 – not important)
Source: Prepared by paper authors, based on experts' responses

In spite of similarity of the analysed economies, the IT companies in these two markets are at different evolution stages. Having a richer and longer experience in building innovation culture via HR, South

Korea is more focusing on the R&D efficiency, although the HR function should be continuously up-to-date via process innovation and modern technology in order to maintain the leading position. The Lithuanian experts emphasized the context of rapid development of this economy, where in order to respond to the market changes and consumer expectations, high-tech companies need to skip some steps of innovation culture development without having time to realign cultural aspects towards global pressures; thus, it would be suggested to focus more on innovative HR techniques, a holistic culture and sustainability (See Image 2).

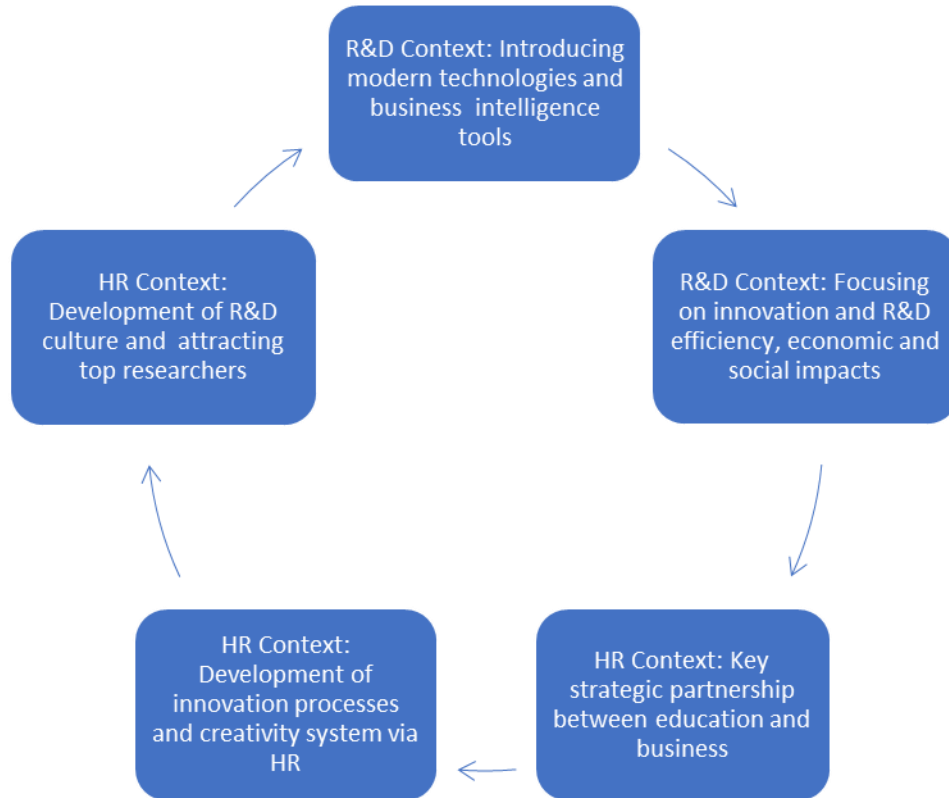


Image 2. The Role of HRM and R&D dimensions within the Evolution of Competitive Advantages of IT Firms

Source: Prepared by paper authors, based on experts' responses

Conclusions and Recommendations

Given the increasing role of innovation culture, HR departments' function in building self-esteem, creativity enhancement, creative leadership, intrapreneurship and many other aspects are critical, along with monitoring, business intelligence and strategic collaboration. Having no understanding why and how technologies are applied, how they work within decision-making model, it is very difficult to identify efficiency criteria of innovative Human Resource Management, which should lead to sustainable business performance, including the technological improvement. The majority of innovation

initiatives should come from employees and other stakeholders if culture is friendly and open to new ideas.

The Lithuanian experts focused on leveraging employees' potential and following a positive experience of South Korea, which similarly to Lithuania didn't have abundance of natural resources and used the potential of high-tech specialists in attracting high-tech investors or developing new ventures in their economy. At macro or mesa level, this transformation trend calls for the improvement of High-Tech study programs at Lithuanian universities and strengthening the role of R&D transfer mechanisms in order to supply an adequate number of graduates for high-tech investors. Thus, at micro and mesa levels, the emphasis on the HR department in Lithuania's case is logical and effective.

A well-established innovation culture, which derives from the Human Resource Department, leads to the ratio of commercialized creative ideas in South Korean companies, slightly higher than in Lithuanian companies (two Korean experts indicated the level up to 25% while the other four underlined the bracket from 25% to 50%; within Lithuanian interrogated companies this number did not exceed one fifth of total ideas).

The comparison of responses of high-tech experts from Lithuania and South Korea is useful for both economies: in spite of their geographical location, differences in cultural and social norms, size and development stage of economies and interrogated firms (they are similar in many aspects, such as education levels, specialization in high-techs or limited natural resources). Therefore, Lithuanian experts could apply the Korean experience in developing a stronger innovation culture with new forms of activities and interaction opportunities between technologies and people (as well as emphasizing the role of the R&D culture), while Korean experts should not take the already developed HR culture for granted and continuously perfect their HR strategies, because the new generations (along with new social pressures) could completely change the rules of the game; thus the innovation system should be open and continuously nourished in order to keep the leading position in the market.

Based on the experts' and scholars' insights, the HR departments in Lithuanian high-tech companies should adopt a holistic bidirectional innovation commercialization model: on the one hand, modern technology and process innovation should help diminish the fragmentation and inefficiency of innovation culture (including creativity system and knowledge transfer) and HRM overall (this process should be rapid and of the first priority), while the R&D and technological improvement dimension should be continually emphasized and strengthened to improve the competitive position in the market. However, abundant HR innovations should be continuously and straight away applied in the R&D projects in order to support other departments (such as Sales and Marketing or R&D). To diminish the gap in HR culture, the accelerated innovation process calls for organic creativity and intrapreneurship ecosystem, faster trial and implementation of technological and managerial innovation as well as more ingenious business intelligence tools while tracking both implementation success of HR techniques and innovation commercialization performance. In spite of complexity of a holistic bidirectional innovation commercialization model, such complex tasks are possible in human capital and education-driven Lithuanian IT companies, if a sustainable and efficient learning process is implemented.

References

- Abdi, K.; Mardani, A.; Senin, A.A.; Tupentaite, L.; Naimaviciene, J.; Kanapeckiene, L.; Kutut, V. (2018). The Effect of Knowledge Management, Organizational Culture and Organizational Learning on Innovation in Automotive Industry. *Journal of Business Economics and Management*, Vol. 19, No. 1, pp. 1-19 <https://doi.org/10.3846/jbem.2018.1477>
- Armstrong, M.; Brown, D. (2019). Strategic Human Resource Management: Back to the future? A literature review, Report 517, p. 50, Available online: https://www.employment-studies.co.uk/system/files/resources/files/517_Strategic-Human-Resource-Management-Back-to-the-future-IES-CIPD-2019.pdf
- Atkinson, R.D.; Foote, C. (2019). Is China Catching Up to the United States in Innovation? p. 57, <http://www2.itif.org/2019-china-catching-up-innovation.pdf>
- Boon, C.; Hartog, D.N.D.; Lepak, D.P. (2019). A Systematic Review of Human Resource Management Systems and Their Measurement. *Journal of Management*, Vol. 45, No. 6, pp. 2498–2537, DOI: <https://doi.org/10.1177/0149206318818718>
- Carnevale, A.P.; Smith, N. (2013). Workplace basics: the skills employees need and employers want. *Human Resource Development International*, Vol. 16, pp. 491-501, <https://doi.org/10.1080/13678868.2013.821267>
- Centre for Data Innovation by Chivot, E. (2019). Call for European AI Policy Conference, March 25, 2020, available online: <https://www.datainnovation.org/2020/03/european-ai-policy-conference/>
- Clercq, D.; Pereira, R. (2019). Resilient employees are creative employees, when the workplace forces them to be. *Creativity and Innovation Management*, Vol. 28, No. 3, pp. 329-342, <https://doi.org/10.1111/caim.12328>
- Collett, C.; Graham, J.; Lindsay, J. (2019). Innovative leaders & leading innovation. A Theoretical and Practical Analysis White Paper. iOpener Institute for People & Performance, An iOpener Institute Research Paper, May, p. 30, https://iopenerinstitute.com/wp-content/uploads/2019/05/Innovative-Leaders-and-Leading-Innovation_May-2019.pdf
- Delery, J.E.; Roumpi, D. (2017). Strategic human resource management, human capital and competitive advantage: is the field going in circles? *Human Resource Management Journal*, Vol. 27, No. 1, pp. 1–21, <https://doi.org/10.1111/1748-8583.12137>
- Deloitte by Kaji, J.; Hurley, B.; Gangopadhyay, N.; Bhat, R.; Khan, A. (2019). Leading the social enterprise: Reinvent with a human focus, 2019 Deloitte Global Human Capital Trends, p. 112, https://www2.deloitte.com/content/dam/insights/us/articles/5136_HC-Trends-2019/DI_HC-Trends-2019.pdf
- Deloitte, prepared by Seeger, S.; Hurley, B.; Bhat, R. (2019). Innovation in Europe. A Deloitte survey on European companies and how digital technologies can strategically enhance innovation, p. 28, https://www2.deloitte.com/content/dam/insights/us/articles/DE_897_Innovation-in-Europe/DI_Innovation-In-Europe.pdf
- Department for Digital, Culture, Media and Sport, the UK (2019). Culture is Digital, June 2019 Progress Report, p. 38, Available online: www.gov.uk/dcms
- EvaluatePharma (2019). World Preview 2019, Outlook to 2024, 12th Edition – June 2019, p. 26, https://info.evaluate.com/rs/607-YGS-364/images/EvaluatePharma_World_Preview_2019.pdf
- Gonera, A.; Pabst, R., (2019). The Use of Design Thinking in Transdisciplinary Research and Innovation Consortia: Challenges, Enablers and Benefits. *Journal of Innovation Management*, Vol. 7, No. 3, pp.96-122, DOI: https://doi.org/10.24840/2183-0606_007.003_0006
- Halim, H.A.; Ahmad, N.H.; Ramayah, T. (2019). Sustaining the Innovation Culture in SMEs: The Importance of Organisational Culture, Organisational Learning and Market Orientation. *Asian Journal of Business Research* Vol. 9, No. 2, p. 20. <https://doi.org/10.14707/ajbr.190059>
- Hammond, M.; Cross, C.; Farrell, C. Eubanks, D. (2019). Burnout and innovative work behaviours for survivors of downsizing: an investigation of boundary conditions. *Creativity and Innovation Management*, Vol. 28, No. 3, pp. 306-317. <https://doi.org/10.1111/caim.12327>
- Isaacs, K.; Ancona, D. (2019). 3 Ways to Build a Culture of Collaborative Innovation, *Harvard Business Review*, August 12, 2019, <https://hbr.org/2019/08/3-ways-to-build-a-culture-of-collaborative-innovation>

ISG Confidential (2019). 2019 Industry Trends in HR Technology and Service Delivery. A report exploring the challenges and opportunities facing HR organizations today, 2019 March, p. 33, https://isg-one.com/docs/default-source/default-document-library/2019-hr-tech-survey-report.pdf?sfvrsn=9f64c231_0

Jin, Z.; Navare, J.; Lynch, R. (2019). The relationship between innovation culture and innovation outcomes: exploring the effects of sustainability orientation and firm size. *R&D Management*, Vol. 49, No. 4, pp. 607-623, <https://doi.org/10.1111/radm.12351>

Kane, C.G.; Palmer, D.; Phillips, A.N.; Kiron, D.; Buckley, N. (2019). Accelerating Digital Innovation inside and out; Agile Teams, Ecosystems, and Ethics, MIT Sloan Management Review, June 04, Findings from the 2019 Digital Business Global Executive Study and Research Project In collaboration with Sponsor Logo, <https://sloanreview.mit.edu/projects/accelerating-digital-innovation-inside-and-out/>

Kavurmaci, A. (2018). The Place of R&D and Education Policies in South Korea's Economic Development *Journal of Social Policy Conferences*, Vol. 74, pp. 51–64, <https://doi.org/10.26650/jspc.2018.74.0003>

Kim, H.; Park, S.Y.; Joh, W.I. (2019). A Study on Technology Development Performance and Technology Commercialization Performance (According to the Technology Development Capability of SMEs Focusing on a Comparative Analysis of Technology Business Groups). *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 5(3), No. 65, p. 19, <https://doi.org/10.3390/joitmc5030065>

Koehorst, M.; van Deursen, A.; van Dijk, J.; De Haan, J. (2019). Exploring the Creative Industries: toward a Classification by Process and Job Functions. *Journal of Innovation Management*, Vol.7, No.3, pp. 69-95, DOI: https://doi.org/10.24840/2183-0606_007.003_0005

Lauzikas, M.; Mokseckienė, R. (2013). The Role of Culture on Entrepreneurship in Lithuania. *Social Research*, No. 2, Vol. 31, pp. 55–69, ISSN 1392-3110, <https://vb.mruni.eu/object/elaba:6092663/>

Lauzikas M.; Miliutė A. (2017). The Role of Education on Entrepreneurship in Lithuania. In: Sauka A., Chepurenko A. (eds) *Entrepreneurship in Transition Economies. Societies and Political Orders in Transition*. Springer, Cham; ISBN: 978-3-319-57341-0 (Print) 978-3-319-57342-7, https://doi.org/10.1007/978-3-319-57342-7_9

Lauzikas, M.; Miliute, A. (2019a). Transformational Communication via Evolving Ethical and Moral Norms of Lithuanian Civil Service Organizations, *Entrepreneurship and Sustainability Issues*, Vol. 6, No. 4, pp. 1750-1761, [https://doi.org/10.9770/jesi.2019.6.4\(14\)](https://doi.org/10.9770/jesi.2019.6.4(14))

Lauzikas, M.; Miliute, A. (2019b). Communication Efficiency and Effectiveness within Strategic Management of Change: insights into Civil Service Organizations, *Journal of Security and Sustainability Issues*, Vol. 8, No. 4, pp. 617-630, [https://doi.org/10.9770/jssi.2019.8.4\(6\)](https://doi.org/10.9770/jssi.2019.8.4(6))

Lee, H.W.; Pak, J. Kim, S.; Li, L.Z. (2019). Effects of Human Resource Management Systems on Employee Proactivity and Group Innovation. *Journal of Management*, Vol. 45, No. 2, pp. 819-846, <https://doi.org/10.1177/0149206316680029>

Lee, J.; Suh, T.; Roy, D.; Baucus, M. (2019). Emerging Technology and Business Model Innovation: The Case of Artificial Intelligence. *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 5(3), No. 44, p. 13, <https://doi.org/10.3390/joitmc5030044>

Leichteris, E.; Izgorodin, A.; Jakubavičius, A.; Jasėnas, A.; Kudarauskiene, A.; Van Der Molen, S.; Leiputė, B.; Bacevičius, P. (2019). *Lithuanian Industry Digitisation Roadmap 2019-2030*, Ministry of the Economy and Innovation, p. 17, https://industrie40.lt/wp-content/uploads/2019/03/Lithuanian-Industry-Digitisation-Roadmap-2019-2030_final.pdf

Lithuanian Laser association (2019). *Laser Technologies in Lithuania*, publication initiated and published by the Fifth revised edition, p. 29, http://www.ltoptics.org/uploads/documents/Laser%20Technologies%20in%20Lithuania_2019.pdf

Marwede, M.; Herstatt, C. (2019). No innovation for the elderly? The influence of cognitive distance in corporate innovation. *Creativity and Innovation Management*, Vol. 28, No.3, pp. 355-367, <https://doi.org/10.1111/caim.12318>

NHS, The Topol Review (2019). Preparing the healthcare workforce to deliver the digital future. An independent report on behalf of the Secretary of State for Health and Social Care, p. 53, <https://topol.hee.nhs.uk/wp-content/uploads/HEE-Topol-Review-2019.pdf>

Odetunde, O.J. (2019). Employee Innovation Process: An Integrative Model. *Journal of Innovation Management*, Vol. 7, No. 3, pp. 15-40, https://doi.org/10.24840/2183-0606_007.003_0003

Peccei, R., Van De Voorde, K. (2019). The application of the multilevel paradigm in human resource management – outcomes research: taking stock and going forward. *Journal of Management*, Vol.45, No. 2, pp. 786-818, <https://doi.org/10.1177/0149206316673720>

Koster, F. (2019). Innovative HRM. A Review of the Literature. *Journal of Technology Management & Innovation*, Vol. 14, No. 2, pp. 97-106, ISSN: 0718-2724, Available online: <https://scielo.conicyt.cl/pdf/jotmi/v14n2/0718-2724-jotmi-14-02-97.pdf>

Schoff, J.L.; Ito, A. (2019). Competing with China on Technology and Innovation, Alliance Policy Coordination Brief, Carnegie Endowment for International Peace, October, p. 17, https://carnegieendowment.org/files/ChinaRiskOpportunity-China_Tech.pdf

Sull, D.; Sull, C.; Chamberlain, A. (2019). Measuring Culture in Leading Companies, MIT Sloan Management Review and Glassdoor, June 2019, p.17, <https://www.glassdoor.com/research/app/uploads/sites/2/2019/06/Measuring-Culture-Final.pdf>

Tinmaz, H.; Lee, J.H. (2019). A Preliminary Analysis on Korean University Students' Readiness Level for Industry 4.0 Revolution. *Participatory Educational Research (PER)*, Vol. 6, No. 1, pp. 70-83, ISSN: 2148-6123, <http://dx.doi.org/10.17275/per.19.6.6.1>

West, M.A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology: An International Review*, Vol. 51, No. 5, pp. 355–387, <https://doi.org/10.1111/1464-0597.00951>

Wikhamn, W. (2019). Innovation, sustainable HRM and customer satisfaction. *International Journal of Hospitality Management*, Vol. 76, pp. 102–110, 0278-4319 <https://doi.org/10.1016/j.ijhm.2018.04.009>

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A COMPARATIVE STUDY OF PERFORMANCE OF COMMERCIAL BANKS IN ASIAN DEVELOPING AND DEVELOPED COUNTRIES

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Abstract. The main focus of this study is to investigate the impact of non-performing loans (NPLs) and other bank specific factors on the financial performance of commercial banks in Asian developing and developed countries due to an alarmingly high ratio of non-performing loans. The bank specific factors that are used in this study are cost efficiency ratio (CER), capital adequacy ratio (CAR), size of the bank, sales growth (SG) and proxies of financial performance (FP) are return on equity (ROA) and return on asset (ROE). Secondary Panel data of ten years (2006-2015) has been used for this empirical analysis and 19 commercial banks from developing countries of Asia (Pakistan and India), while 17 commercial banks from developed countries of Asia (Japan and Saudi Arabia) are selected. Generalized method of moment is used for the coefficient estimation to overcome the effects of some endogenous variables. NPLs and CER are significantly negatively related to the financial performance (ROA and ROE) of developing and developed countries commercial banks. There is a negative relationship of bank size with most of financial performance variables. Sales growth and capital adequacy ratio has significant positive relationship both measures of financial performance (ROA and ROE) in both pools. Due to the importance of commercial banks in the overall economy of a country, there is a need for management of commercial banks and regulatory authorities to undertake policies that ensure efficiency in banking operations.

Keywords: Non-Performing Loans, micro economic variables, Pakistan & India, Japan & Saudi Arabia, GMM approach

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JEL Classifications: B21, D00, G21, G15

1. Introduction

Around the globe, commercial banks are vital organ of any economy due to their intermediary role and wide ranging financial services that they provide to the community and the nation at large. Well functioning commercial banks increase the economic growth of a country and poor performance of commercial banks increase the chances of failure, eventually leading to financial crisis. Lending is considered the heart of banking industry and by issuing loans commercial banks want to maximize their earnings (Negeera, 2012). Commercial banks want to maximize their lending but poor lending decisions increase the ratio of non-performing loans. According to Berger and DeYoung (1997) non-performing loans (NPLs) are considered a major threat to banking

not only in developing countries but also for developed countries. When NPLs increase, it is widely considered that the credit policy of that institution is at fault resulting in the reduction of bank earnings (Saba, kouser, & Azeem, 2012).

Asia is one of the most important continents of the world and consists of 48 countries. According to the Asian development bank (2016) Asia contributes to 60% in the world growth. Despite of this growth the ratio of NPLs is alarmingly high in Asia. According to Akhtar, Ali and Sadaqat (2011) the non-performing loans and internal factors (the factors are under the control of management) are main reason for commercial banks failure that even lead to the Asian currency crisis (1997) and crisis subprime crisis (2007). Although in the present environment Asian commercial banks have tried to manage the bank specific factors and non-performing loan ratio has decreased in Asia by 10% but it is still a serious concern. This ratio of non-performing loan is very high in Asian countries as compared to other developed countries. Despite of a lot of authors (Bloem & Gorter, 2001; Saba, kouser, & Azeem, 2012, Chimkono, et al., 2016) have addressed these issues but literature shows that the results of are inconclusive. So, the study aims to further explore the phenomena of NPLs and banks specific factors in a unique comparative study of developed and developing countries from only Asia.

2. Literature Review

The literature review section is divided in two parts. First part is theoretical review of dependent and independent variables. In second and last part is empirical review, which is consisting of the relationship NPLs and financial performance and also includes the relationship between bank specific factors and financial performance of a firm.

2.1 Theoretical Review

Banking industry is considered the back bone of a country because it is working for the financial stability of all business activity. Subsequent “Basel Accords” have imposed some regulations on the global banking industry, resulting in banking performance improvement but at a same time banking industry has faced some financial crisis for the last few decades. According to Krueger (2000) all financial crisis are the result of non-performing loan. The term of NPLs is firstly used by USA in 1987 after the terrible financial crisis, according to IMF, a loan is considered non-performing when the payment of principle or interest (both at a time) are still due after 90 days or more have been passed.

Balasubramaniam (2012) explains some reasons of Non-Performing Loans (NPLs) Matter. Firstly, it affects the profitability of bank not only short term profitability but also long term profitability. Moreover investments (ROI) also decrease due to the high ratio of NPLs. Secondly, NPLs create liquidity problems in bank resulting reduced loan giving capacity. Thirdly, management spends a lot of time and effort to manage the non-performing asset and it is another indirect cost for banks. Lastly, it affects the banks creditworthiness leading to lower deposits.

Bank specific variables are banks internal or micro economic variables. According to Adebayo, Adeyanju and Olabode (2011) management can control their internal factors and these variable influence the financial statements of banks directly and indirectly. Unsystematic risk or diversifiable risk is associated with these factors (Masood & Ashraf, 2012).

2.2. Empirical review

2.2.1. Non performance loan (NLPs) and financial performance of bank

Several studies have been conducted to investigate the impact of NPLs and banks financial performance (Berger and DeYoung, 1997; MUASYA, 2008; Saba, Kouser, & Azeem, 2012; Lata, 2015, Chimkono et al., 2016). Saba,

kouser and Azeem (2012) found that there significant negative relation between the NPLs and financial performance.

Alshatti (2015) conducted a study on Ghana region to investigate the relationship between credit risk management and profitability of rural banks. Five year panel data (2006 to 2010) where a number banks are ten concludes that there is significant positive relationship between NPLs and financial performance. Lata (2015), conduct the research to investigate the relationship between non performing loan and banks profitability and found that there is a significant negative relationship between non performance loan and banks financial performance. Lipunga (2014) conducted the study on Nigerian banks with secondary data (2006-2012) found that there was no relationship of NPLs and return on asset while there is a significant relationship between non-performing loan and return on equity. There is a negative relationship between NPLs and banks performance (MUASYA, 2008). Other authors (Krueger, 2000; Bloem & Gorter, 2001; Saba et al., 2012; Chimkono et al., 2016) also concluded on the same issue that there is inverse relationship between NPLs and banks financial performing. It means if NPLs increase then banks financial performance decreases and vice versa.

2.2.2. Bank specific variable and financial performance of bank

Bank specific variable are internal factors of the banks and there are different bank specific factors like cost efficiency ratio, size, capital adequacy ratio and sales growth. Cost efficiency ratio indentifies how to efficiently control the cost of a bank. Different research studies show that the cost efficiency ratio (Berger and DeYoung, 1997; Karim, Chan & Hassan, 2010; Chimkono et al., 2016). Berger and DeYoung (1997) do a study on problem loans and cost efficiency in commercial banks when management have no control on their operation and are not performing well on day to day basis. In this case their loan portfolio decrease and cost efficiency ratio also increase.

Karim et al., (2010) conducted a study to investigate the relationship between NPLs and bank efficiency. This study is based on Malaysian and Singaporean banks data is collected from both banks over the period of 1995 to 2000. Tobit simultaneous equation regression model was used for estimation and result shows that an inverse relationship exists between NPLs and bank efficiency.

Adebayo, Adeyanju and Olabode (2011) investigate the relationship between financial performance and cost efficiency. They collected data of seven years (2000 to 2007) from 29 Sub-Saharan African countries and found insignificant negative relationship between cost efficiency and profitability of a bank. Mausya (2008) conducted a research on South Africa banking sector to check the nature of relationship between cost efficiency and profit efficiency and data was collected from the period of 2000 to 2005. The result of this study proved that there is a weak negative correlation between cost efficiency and profit efficiency. Chimkono et al., (2016) found that there is insignificant positive relationship of cost efficiency ratio and financial performance of commercial banks.

A firm size describes its production capacity and the service that firm is providing to its customer. Goods and services are produced at low price in a large firm as compared to small firms (Masood & Ashraf, 2012). Masood and Ashraf (2012) conclude that there is a positive association between firm size and profitability of a firm because large firms have a large size of asset through which they get benefit. Saba, kouser and Azeem, (2012) on the other hand conclude that small companies better than large companies. Adebayo, Adeyanju and Olabode (2011) indentify that there is non-significant relationship between firm size and profitability of a firm.

Capital is considered very important for the effective functioning of every business including the banking sector because it has an ability to absorb any loss that is faced by the business and investor have confidence on that business because insolvency risk of that business is low. Every business especially banking industry needs this confidence, so that borrowers give their money without any risk of insolvency or bankruptcy.

According to Basel accords minimum capital adequacy ratio (8%) should be maintained by each bank. According to Lipunga (2014) capital is used to help the depositors and counterparties of the financial organization to protect them from the risk that are associated with on-balance sheet items and off-balance sheet items. Therefore positive relationship with financial performance. According to Akhtar, Ali and Sadaqat (2011) and Masood and Ashraf (2012) there is a insignificant negative relationship between capital adequacy ratio and return on equity. According to Delmar, Davidsson and Gartner (2003) in today's world firms are giving much value to the growth of the sales and therefore includes with the statements "We plan that in next five years our company sales would be to double sales," or "Our objective is that our sales of a company would be \$2 billion during the period of 7 years". They also tell us that the sales growth of company is affected by different variables which include promotion of sales, employees' motivation and retention factors of talented employees. To achieve these goals and keeps employees motivated, companies set a percentage of reward that is given by achieving on specific sales goals. Most of the researchers Delmar, Davidsson and Gartner (2003), Karim et al., (2010), Negera (2012) and Chimkono et al., (2016) conclude that there is positive relationship between sales growth and financial performance of banks. Although some researchers Balasubramaniam (2012) and Alshatti (2015) pointed that there is insignificant and negative relationship between sales growth and financial performance.

3. Methodology

This study investigates the impact of nonperforming loans and some bank specific factors (cost efficiency ratio, capital adequacy ratio, sales growth and bank size) on the profitability of commercial banking sector. Panel data has been collected from financial statements of four developed and developing countries of Asia. Developing countries are Pakistan, India and developed countries Japan, Saudi Arabia. The number of banks from Pakistan (10 commercial banks), India (9 commercial banks) Japan (10 commercial banks) and Saudi Arabia (8 commercial banks). The data has been collected from the period of 2006 to 2015, the data of this study is panel in nature. One control variable is inflation whose data has been collected from world bank website. The summary of explanatory variables and dependent variables are given in the table 3.1.

Table 3.1. Summary of explanatory variables and dependent variables

		Name of variable	Symbol	Measurement
Dependent Variable	Financial performance	Return on Asset	ROA	$\frac{\text{Net income}}{\text{Total Assets}}$
		Return on Equity	ROE	$\frac{\text{Net income}}{\text{Total common equity}}$
Independent variable	Non-performing loans	Non-performing loans	NPLs	$\frac{\text{total non – performing loan}}{\text{Total loans}}$
	Bank specific factors	Cost efficiency ratio	CER	$\frac{\text{Total operating cost}}{\text{total revenue}}$
		Capital adequacy ratio	CAR	$\frac{\text{Risk weighted assets}}{\text{Total equity}}$
		Sales Growth	SG	$\frac{\text{Current year sales – previous year sales}}{\text{Previous year sales}}$
		Bank Size	Size	Log (total assets)
Control Variables		Inflation	Inflation	Annual inflation rate declared by word bank
		Age	Age	Age of commercial banks

Hypotheses

H1a: There is negative and significant relationship between NPLs and ROA.

H1b: There is negative and significant relationship between NPLs and ROE.

H2a: There is negative and significant relationship between CER and ROA.

H2b: There is negative and significant relationship between CER and ROE.

H3a: There is positive and significant relationship between CAR and ROA.

H3b: There is positive and significant relationship between CAR and ROE.

H4a: There is positive and significant relationship between Size and ROA.

H4b: There is positive and significant relationship between Size and ROE.

H5a: There is positive and significant relationship SG between and ROA.

H5b: There is positive and significant relationship SG between and ROE.

Model specification

The general form of regression model is;

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$$

Where

I=cross sectional dimension

t= time series dimension

Y_{it}= dependent variable

X_{it}= dependent variables

α =intercept

β =slope and ε_{it} = random error term

According to Baltagi (2008) and Gujarati (1995) that in panel data the researcher uses time series data and cross sectional data in one study. He also pointed out that panel data is solution of heterogeneity that is related to different units of a one variable. According to Baltagi (2008) panel data may faces two serious threat, first is autocorrelation and secondly endogeneity. There are different test for testing autocorrelation but “Wooldridge test” to test the autocorrelation is used in this study. The p - value of Wooldridge test all are zero, so it means that all p-values are less than 0.05. It means that it rejects the null hypothesis and the null hypothesis is that our data has no autocorrelation but the results shows that data has autocorrelation problem.

According to Tosuni (2013) Hausman test results probabilities can be used to test the endogeneity and null hypothesis of this test is that error are uncorrelated. They also pointed out that if the probabilities are more than 0.10 then we have failed to reject null hypothesis.

The APPENDIX (A) shows that some values of hausman test are less than 0.10, so it means that data has the problem of endogeneity. As the two assumption of CLRM model are not meet assumptions than the results of regression are not blue. So in this study used an instrumental regression (generalized method of movement) that handles all these issues. According to Gujarati (1995) GMM handles this issue of autocorrelation and endogeneity. If pooled regression is applied then the results were biased because the coefficient results can not given accurate meaning because pool regression ignore year and cross section wise variation (Baltagi, 2008, p.13). As the number of cross sectional units (N) is greater than the number of time series unit then regression model can be estimated by two method fixed effect and random effect models. According to Tosuni (2013) Hausman test results tell us whether fixed effect or random effect model applied.

The regression model is as follow;

Model 1

$$(ROA)_{it} = \beta_0 + \beta_1(NPLs)_{it} + \beta_2(SIZE)_{it} + \beta_3(CAR)_{it} + \beta_4(CER)_{it} + \beta_5(SG)_{it} + \beta_6(INFR)_{it} + \beta_7(AGE)_{it} + \varepsilon_{it} \quad (1)$$

Model 2

$$(ROE)_{it} = \beta_0 + \beta_1(NPLs)_{it} + \beta_2(SIZE)_{it} + \beta_3(CAR)_{it} + \beta_4(CER)_{it} + \beta_5(SG)_{it} + \beta_6(INFR)_{it} + \beta_7(AGE)_{it} + \varepsilon_{it}$$

4. Analysis

To analyze relationship non-performing loans and some bank specific factors on the profitability, firstly, the study applies then descriptive statistics; correlation analysis and lastly the regression section describe the cause and effect relationship between these variables. Moreover t test is also performed who values are less than 0.05. It means that the mean value of both groups is significantly different from each others.

4.1. Distribution of the data

APPENDIX (B) shows the minimum and maximum value of ROE -268.75,100.15 respectively and both value lies in developed countries. It means a big variation in this pool. The average value of ROA and CAR (0.9, 13) respectively in both pools. CAR all values lies between 2 to 7 in developed and developing countries. There is great dispersion has been observed in the value of CER, SIZE,SG, AGE, and INF whose minimum values are 20,2,-44,5,-1 and maximum value 126,7,110,138,10 respectively.

4.2. Correlation

Correlation analysis is basically used to check the linear relationship present between the two explanatory variables or not (Brooks, 2014, p. 28). Tosuni (2013) mentioned in their study that if that sample size approaches to 100 or great than 100 then if correlation coefficient is 0.20 then correlation is significant at 5% and our both pools data are greater than 100 observations.

In APPENDIX (c) most of the variables of the study are significantly positively associated at 5% with the financial performance but NPLs and CER are significantly negatively associated with financial performance in both pools that support literature. Control variable state has insignificance with some of the dependent, independent and control variables.

To investigate the nature of relationship between NPLs and bank-specific factors with financial performance, we estimate two models as reported in Tables 4.3 and 4.4.

4.3. Regression analysis

APPENDIX (D) and APPENDIX (E) presents the fixed effects model results. The coefficient were calculated by the use GMM because the issue of endogeneity. Hausman test is applied to check fixed or random effect is appropriate and H_0 : Random effect model is appropriate but the p-value of hausman test is 0.000 for developing and developed countries for both the dependent variables ROA and ROE with all other independent variables . In other words we are failed to accept null hypothesis in both pools.

To remove the issue of endogeneity, the coefficient were calculated by the use of GMM. The values of Durban Watson are 1.6552 and 2.0197for both models. It means the problem of auto correlation is also removed in our data.

Most are variables are significant at 5% and 1% while CAR, size and control variables are insignificant in some cases. NPLs ratio and CER are significant negative relationship with ROA and ROE in both pools regressions which support our hypothesis H1a, H1b, H2a and H2b. These results are consist with Saba, kouser and Azeem

(2012) who found that there is negative relation between NPLs, CER and financial performance of commercial banks.. According to Berger and DeYoung (1997) if a bank has poor management then it would result in poor quality loans that result in an increase in cost efficiency ratio. So it means management lacks good internal controls.

CAR is significant positively relationship with ROA and ROE in both pools but insignificant with ROE in developed countries pool. So H3a is accepted in both developing and developed countries pool but h3b only accepted in developing countries. our finding matches the findings of Masood and Ashraf (2012) who found that there is significant positive relationship between ROA and CAR while insignificant relationship exist between ROE and CAR. According to economic survey by world bank (2012) when so banks has enough capital to meet risk weighted assets then automatically financial performance is also increased.

Size is significantly negative association with ROA and ROE in both pools but insignificant with ROE in developing countries pool. So H4a, H4b are rejected and our here matched with the finding of Chimkono et al., (2016) who conclude that there is negative relation between banks size and performance. It points out that small bank has high performance as compared to large because small banks have the ability to effectively managed their assets. SG has positively relationship with all measures (ROA and ROE) of both pools, so H5a and H5b are accepted in both developed and developing countries pools. These results are consistent with Kaplan and Norton (1992) who pointed out that by increasing sales financial performance of any firm also increased. Two control variables age is insignificant linked with most depend variables and inflation is significantly negative associated with most depend variables.

5. Conclusions

The present study has empirically examined the impact of non-performing loans and bank specific factor on financial performance of commercial banks over the period of 2006 to 2015. The study collected the data of four countries of Asia, where two of them are developing (India and Pakistan) and remaining two countries are developed (Japan and Saudi Arabia) and data is collected from thirty six banks. The empirical results revealed the following findings: Non-performing loan and cost efficiency ratio have significant negative effect on financial performance (ROE, ROA) of commercial banks in both pools (Asian developing and developed). Capital adequacy ratio has significant positively relationship both measures of financial performance (ROA and ROE) in both pools but have insignificance with ROE in developed countries. Sale growth has positively relationship with all measures of financial performance (ROA and ROE) of both developing and developed countries pools. Bank size has significantly negative relationship with ROA and ROE in both pools but insignificant with ROE in developing countries pool. The current study has some following recommendations: Firstly, direction process of loan approval and monitoring system of commercial banks should be strong in both developing and developed countries to reduce the high ratio of Non-performing loans in Asia. Secondly, the management of commercial banks of both pools (Asian developing and developed) should need to continuously work on operational efficiency by reducing their operational cost by effectively managing all those internal factors which are under the control of management to increase revenues.

Concerning areas of further research, the present study was only limited to investigate the impact of nonperforming loans and bank specific factors on financial performance of Asian developing and developed countries commercial banks. This study can be extended by adding more countries of Asia (not only four countries) but other researchers can also take some other continents. Another study should also be carried out by increasing the number of banks or can increasing number of years of data.

References

- Adebayo, M., D. Adeyanju and S. Olabode, (2011). Liquidity Management and Commercial Banks' Profitability in Nigeria. *Research Journal of Finance and Accounting*, 2(8)
- Akhtar, M. F., Ali, K., & Sadaqat, S. (2011). Factors influencing the profitability of Islamic banks of Pakistan. *International Research Journal of Finance and Economics*, 66, 125-132.
- Alshatti, A. S. (2015). The effect of credit risk management on financial performance of the Jordanian commercial banks. *Investment Management and Financial Innovations*, 12(1), 338-345.
- Balasubramaniam, C. S. (2012). Non-performing assets and profitability of commercial banks in India: assessment and emerging issues. *National Monthly Refereed Journal Of Research In Commerce & Management*, June, volume, (1), 41-52.
- Baltagi, B. (2008). *Econometric analysis of panel data*. John Wiley & Sons.
- Berger, A. N., & DeYoung, R. (1997). Problem loans and cost efficiency in commercial banks. *Journal of Banking & Finance*, 21(6), 849-870.
- Brooks, C. (2014). *Introductory econometrics for finance*. Cambridge university press.
- Chimkono, E. E., Muturi, W., & Njeru, A. (2016). Effect of non-performing loans and other factors on performance of commercial banks in malawi. *International Journal of Economics, Commerce and Management*, IV, 1-15.
- Delmar, F., Davidsson, P., & Gartner, W. B. (2003). Arriving at the high-growth firm. *Journal of business venturing*, 18(2), 189-216.
- Gorter, M. C., & Bloem, M. A. M. (2001). The treatment of nonperforming loans in macroeconomic statistics (No. 1-209). *International Monetary Fund Growth and Firm Performance. Strategic Management Journal*, 455-472.
- Gujarati, D. (1995) *Basic Econometrics*, 3rd edn., McGraw-Hill, New York.
- Kaplan, R. S. & Norton, D. P. (1992). The Balanced Scorecard - Measures The Drive Performance. *Harvard Business Review*, 92105, 71-79.
- Karim, M. Z. A., Chan, S. G., & Hassan, S. (2010). Bank efficiency and non-performing loans: Evidence from Malaysia and Singapore. *Prague Economic Papers*, 2(2010), 118-132.
- Krueger, Anne O. (2000). Conflicting demands on the international monetary fund. *American Economic Review* 90(2), 38-42.
- Lata, R. S. (2015). Non-Performing Loan and Profitability: The Case of State Owned Commercial Banks in Bangladesh. *World Review of Business Research*, 5(3), 171-182.
- Lipunga, A. M. (2014). Determinants of profitability of listed commercial banks in developing countries: evidence from Malawi. *Research Journal of Finance and Accounting*, 5(6), 41-49.
- Masood, O., & Ashraf, M. (2012). Bank-specific and macroeconomic profitability determinants of Islamic banks: The case of different countries. *Qualitative Research in Financial Markets*, 4(2/3), 255-268.
- Mausya, W. B. (2009). The impact of non-performing loans on the performance of the banking sector in Kenya. An MBA project submitted to the University of Nairobi.
- Negera, W. (2012). *Determinants of Non Performing Loans The case of Ethiopian Banks* (Doctoral dissertation, University of South Africa).
- Saba, I., Kouser, R., & Azeem, M. (2012). Determinants of Non Performing Loans: Case of US Banking Sector. *The Romanian Economic Journal*, Year XV, 44.
- Tosuni, G. (2013). *The impact of corporate governance on the performance of financial institutions* (Doctoral dissertation, Staffordshire University).

APPENDIXES

APPENDIX (A)

Developed countries (ROE)			
Variable	Fixed	Random	Prob.
NPL	-1.38144	-0.91854	0.1886
CAR	0.008182	-0.09601	0.1916
CER	-0.32861	-0.23254	0.0012
SG	0.029615	0.088314	0.0001
INFL	-0.39015	0.087808	0.0216
AGE	-0.68765	-0.00768	0.0066

Developed countries (ROA)			
Variable	Fixed	Random	Prob.
NPL	-0.10704	-0.14153	0.0946
CAR	0.034439	0.042175	0.0801
CER	-0.01569	-0.01485	0.6126
SG	0.007571	0.006379	0.1690
SIZE	-0.83722	-0.17166	0.0079
INFL	-0.04208	0.032532	0.0000
AGE	-0.00609	-0.00294	0.8400

Developing countries (ROE)			
Variable	Fixed	Random	Prob.
NPL	-0.8904	-2.10561	0.9468
CAR	0.008182	-0.09601	0.6395
CER	-0.32861	-0.23254	0.5979
SG	0.029615	0.088314	0.5599
SIZE	-12.0826	0.382527	0.1095
INF	-0.39015	0.087808	0.8251
AGE	-0.68765	-0.00768	0.2538

Developing countries (ROA)			
Variable	Fixed	Random	Prob.
NPL	-0.066068	-0.034634	0.0046
CAR	0.001613	0.068108	0.0002
CER	-0.027827	-0.030749	0.8033
SG	0.011874	0.01115	0.7116
SIZE	-4.446678	0.339918	0.0000
INFL	-0.055072	-0.053349	0.8938
AGE	0.273576	-0.002688	0.0000

APPENDIX (B)

Developing countries					Developed countries			
Variable	Mean	Max	Min	Std.	Mean	Max	Min	Std.
ROA	0.9662	4.911	-0.4845	0.9951	0.9864	10.4089	-6.2349	1.9057
ROE	9.4823	66.1649	-13.727	8.610	7.9641	100.158	-268.76	39.176
NPLs	2.5639	6.200	0.2395	1.1889	7.206	64.0583	0.2714	9.6599
CAR	13.617	26.800	-15.00	3.9391	13.885	39.13	1.050	4.1834
CER	68.723	126.003	20.0382	20.477	27.92	68.6964	13.0509	9.8081
SG	1.9054	52.3656	-31.709	12.179	22.171	109.766	-44.859	20.317
SIZE	6.081	7.1948	4.6111	0.8674	3.899	5.0019	2.3184	0.5891
AGE	62.082	138.0	27.000	25.589	49.132	111.0	5.000	34.171
INF	1.9918	9.8700	-1.35	2.5915	9.4493	20.920	2.540	3.8914

APPENDIX (C)

Variables	ROA	ROE	NPLs	CAR	CER	SG	SIZE	AGE	INF
ROA		0.76	-0.23	0.18	-0.17	0.14	0.3	-0.01	-0.01
ROE	0.78		-0.38	0.16	-0.2	0.16	0.3	0.02	-0.17
NPLs	-0.62	-0.5		-0.28	0.06	-0.29	-0.21	-0.18	0.16
CAR	0.56	0.3	-0.3		0.41	-0.14	-0.03	-0.06	-0.02
CER	-0.83	-0.73	0.57	-0.42		-0.13	-0.34	-0.31	0.02
SG	0.38	0.39	-0.32	0.11	-0.35		0.02	-0.11	0.04
SIZE	-0.48	-0.31	0.2	-0.2	0.39	-0.09		0.1	-0.16
AGE	-0.5	-0.31	0.34	-0.33	0.36	-0.12	0.49		-0.14
INF	0.61	0.41	-0.41	0.45	-0.55	0.14	-0.54	-0.37	

APPENDIX (D)

Regression of developing countries commercial banks				Regression of developed countries commercial banks		
ROA				ROA		
Variable	Coefficient	Std.Error	Prob.	Coefficient	Std.Error	Prob.
C	11.016	5.3891	0.0427	3.1163	0.2305	0.0000
NPL	-0.0774	0.0303	0.0118**	-0.0346	0.0129	0.0101**
CER	-0.0316	0.0116	0.0095*	-0.014	0.0026	0.0095*
CAR	0.0332	0.0148	0.0363**	0.0156	0.0051	0.0027*
SG	0.0505	0.0132	0.0163**	0.0014	0.0006	0.0289**
SIZE	-2.723	1.8046	0.0919***	-0.1443	0.0645	0.0271**
AGE	0.1235	0.0899	0.1245	-0.0111	0.0028	0.0001*
INF	-0.0208	0.0091	0.0428**	-0.0113	0.17596	0.1785
Durbin-Watson stat		1.6552			2.0197	
R-squared		0.7536			0.6606	
Adjusted R-squared		0.7112			0.5966	
F-statistics		8.469			11.3979	
Prob(F-stat)		0.0000			0.0000	
Hausemen test(chi-		13.4503			11.031	
P-value(chi-square)		0.0000			0.0000	
J-statistic		0.224			0.3598	
Prob(J-statistic)		0.0769			0.5486	

Significance level: *significant at 1 percent; ** significant at 5 percent; ***significant at 10 percent.

APPENDIX (E)

Regression of developing countries commercial banks				Regression of developed countries commercial banks		
ROE				ROE		
Variable	Coefficient	Std.Error	Prob.	Coefficient	Std.Error	Prob.
C	13.03027	65.187	0.8418	66.8335	8.3339	0.0001
NPL	-1.17270	0.4621	0.0121**	-0.4892	0.2010	0.0115**
CER	-1.19700	0.4729	0.0123**	-0.2652	0.0181	0.0000*
CAR	1.95775	0.8959	0.0303**	0.02979	0.1001	0.7665
SG	0.27620	0.13586	0.0436**	0.05232	0.0197	0.0089*
SIZE	-15.9118	21.45493	0.4594	-5.2219	2.034	0.0113**
INF	-1.69060	0.6253	0.0076*	-0.0237	0.0021	0.0102**
AGE	1.65906	1.45817	0.2569	-0.2 931	0.4040	0.3620
Durbin-Watson stat		1.6849			1.9951	
R-squared		0.51847			0.7617	
Adjusted R- squared		0.4453			0.7167	
F-statistics		61.3431			61.3431	
Prob(F-stat)		0.0000			0.0000	
Hausemen test(chi- sq)		56.3705			56.3705	
P-value(chi- square)		0.0000			0.0000	
J-statistic		2.0203			5.2041	
Prob(J- statistic)		0.052			0.0744	

Significance level: *significant at 1 percent; ** significant at 5 percent; ***significant at 10 percent.

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IMPACT OF INFORMATION TECHNOLOGY ON STRATEGIC MANAGEMENT IN THE BANKING SECTOR OF IRAQ*

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Abstract. The main objective of the study is to examine the impact of information technology on strategic management in the banking sector. The specific objectives are to identify the applications of information technology in banking sector; to examine the association between education level and customer's usage of IT applications in the banking sector; and to examine the relationship between information technology and organization's strategy. The methodology of the study is supported by interview of bank customers and interview of industry experts based on purposive sampling technique. The findings revealed that Electronic cards, ATMs, online banking, electronic payment, and mobile banking were the major application of IT in Iraq banking sector. There is an association between education level of bank customers and their usage of IT applications regarding banking transactions in Iraq. There is a relationship between information technology and organization's strategy which has resulted in value creation and competitive advantage of banks. It was recommended that for better performance of IT on banking, the management of banking sector should adopt better policies that will encourage users to adopt IT usage in banks. The main contribution of this study is that information technology enhances value creation and competitive advantage in Iraq banks.

Keywords: information technology; banking sector; strategic management; IT

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1. Introduction

The evidence of information technology (IT) has become real in the 21st century. Information technology is encapsulation of computer and telecommunication application that is used for storing, transmitting and sending, retrieving and processing data. IT is an essential part of organizational life as it has become life wire for success of any organization (Huber, 1990). Strategic management has been identified as the systemic process of identifying internal and external factors of an organization to describe improved organizational objectives. Strategic management enhances value creation and competitive advantage for the purpose of maximizing profit and minimizing cost.

In the recent time, organizations cannot create value nor achieve competitive advantage without adopting information technology. Evolvement of information technology saves time and monetary cost, and enhances data security. The processes of data collection and storage within an organization were initially challenging before the prevalent usage of computers. The advent of information technology was evidenced by the dominance of computer system, and it has become possible for strategic managers to select relevant information without wasting time. Reddy, Srinivasu, Rikkula, and Rao (2009) noted that most organizations now rely on information technology as it often enhances organization's success. In fact, Keen (1981) perceived that information technology has become the backbone for organization.

The 21st century is a globalized era that is much reliant on information technology across all sectors. Also, organizations have relied more on information technology such that it will be very hard for business to thrive without IT. Before the dominance of information technology, large organizations were known for implementing information technology but now both large and mini organizations now implement information technology.

The aim of this study is to examine the impact of information technology on strategy management with emphasis on Iraq banking industry. The specific objectives are to:

- i. identify the applications of information technology in banking sector;
- ii. examine the association between education level and customer's usage of IT applications in the banking sector; and
- iii. examine the relationship between information technology and organization's strategy in Iraq banks.

2. Literature Review

2.1. Information technology

Information technology implies computers, ancillary equipment, software and hardware, procedures, services (including support services) and related resources. It also includes any equipment or interconnected system or subsystem of equipment, which is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission or reception of data or information (Adeniran,

2016). IT is set of technologies which creates, communicates, acquires, analyzes, saves and transmits information and data (Breznik, 2012). Information technology has become an essential part for any organization's success in today's globalized era. Zuboff (1985) stated that information technology is the computer mediated work where a task is accomplished through the medium of the information system rather than through direct physical contact with the task.

Information technology is required for any organizations success in today's world to gain competitive advantage (Hemmatfar, Salehi, and Bayat, 2010). There seems to be no aspect of human life which remains unaffected by information technology in the recent times. Businesses are carried out in global environment mostly because of the singular factor of IT, and it may be difficult to serve businesses without information technology.

Two basic opposing views exist with regard to the impact of information technology on individuals. In the study of Zuboff, information technology is categorized based on the category of tools involved. There are two major categories, they are:

i. Automated and

ii. Informed

An automated technology seems to deskill the processes that make up the work. This type of technology requires greater control and continuity over the work process, and it can be achieved by substituting technology for human labor with automated devices (Zuboff, 1988). While informed technology, on the other hand, is designed to upgrade or enrich the work processes. Informed technology enhances the removal of most boring, repetitious, dangerous and mindless tasks from the work. Therefore human labor is left to perform the creative, challenging, intellectual and satisfying aspects of the task (Zuboff, 1988).

2.2 Information technology in the banking sector

Provision of quality services to customers is not adequate to create value and achieve competitive advantage over its competitor's. Organizations needed to be more creative, fast and dynamic. Without stressing the essentials, organizations should be more strategic in decision making, and devise better approaches to communicate with customers through information technology. According to Oluwatolani, Joshua, and Philip (2011), internet has become an integral part of human living. Its usage has positively enhanced the adoption of various banking solutions such as online banking.

Competitive advantage has manifested through e-banking in the banking sector. Customers have become even smarter, and their preferences are changing day-by-day. This changing preference of customers makes it difficult for customers to accept average service delivery instead of the demand for excellent services. Customers are the major determinant of what will happen to service providers, that is why they are referred to as king of market. On this note, banks endeavour to retain their customers by providing them excellent services for the purpose of realizing customer retention and customer loyalty. According to Uppal (2011), information technology has become necessary for business survival in the global era.

2.3 Impacts of information technology in banking sector

Oluwatolani, Joshua, and Philip (2011) perceived that e-banking is carrying out banking transactions on electronic devices as it increases efficiency, speeds up delivery timings, made transactions easier with smooth flow of information, checks fraudulent, immediate responses, reduces errors, provides better quality services etc. Information technology has enhanced the usage of ATM (which enables customers to dispense cash at any point

of time regardless of traditional banking hours for services like transfer of funds, payment of utility bills, mini statements, etc), online banking services (enhances customers to perform all their transactions electronically without any physical flow of cash), electronic transfer of funds without issue, internet banking service (for paying bills, transfer funds, check balance statements and perform online transactions electronically), electronic mail (for solving communication issues between banks, customers, organizations and other parties), telephone banking (which enhances transaction via telephone), etc. All these are the benefits of information technology to banking sector.

The review of important literature shows that there are limited studies in the adoption of information technology in banking sector of developing countries. Despite the discussions and affirmation of the impacts of information technology on strategic management in the banking sector, the extent of usage among customers which may often be influenced by their level of education may not have been properly captured. In view of this, the present study delved into the identification of information technology application in the banking sector; determination of the education level of bank customers; and examination of the customer's usage level of IT applications in banking sector. It is believed that this approach is capable of giving a plausible result in the regard.

3. Methodology

Primary data was employed to achieve descriptive statistics. The data was obtained from bank officials and bank customers in Iraq. Questionnaires were designed and distributed for the period of six months through non-probability (purposive) sampling technique. The primary data was collected from 15th March to 14th May 2019 from bank customers who must have experienced the banking services offered by selected banks, and bank officials in Iraq. The study was subjected to subjective criteria, and Statistical Package for Social Science (SPSS) version 20 for Windows 10 was employed for the data entry and data analysis.

The study employs non-probability (purposive) sampling technique; it is a type of non-probability sampling that involves the sample being drawn from part of the population that is close to hand or easy to reach. This technique was adopted because the total population was large, unidentified (Hafaz, Thurasamy, Aziz, Ali and Khan, 2019), and uncertain population that were available in the banking area as at the time of administering the questionnaires. Because of the uncertain number of population in the banking premises at a particular time, judgment was made about the confidence level and the maximum error allowance (Zikmund, 1999). The error allowance was 0.04 based on the discretion of the researcher. The formulae for achieving sample size $n = z^2/4E^2$

where;

n = Sample sizes for the airport terminal;

Z = Z score for the confidence interval 2.05;

E = Error allowance 0.04.

The sample size was approximated to 657 respondents which included the bank officials and bank customers.

Response Rate of Respondents

The study sought to gather information from bank officials and bank customers. A total of six hundred and fifty seven (657) questionnaires were distributed and 502 questionnaires were collected having been filled completely. According to Mugenda and Mugenda (2003), a response rate of 50 percent is adequate for data analysis and reporting; a rate of 60 percent is good and a response rate of 70 percent and over is excellent, this implies that an

approximate of 76.4 percent response rate for this study was suitable for data analysis and reporting (see Table 1). From the same table, questionnaire administration targeted at bank customers and bank officials was carried out for two months. Out of five hundred and two (502) valid questionnaires retrieved, one hundred and fifty seven (157) questionnaires were retrieved from bank officials while three hundred and forty five (345) questionnaires were retrieved from bank customers.

Table 1. Response rate of questionnaires administered to respondents

Banks	Questionnaires Administered	Questionnaires Retrieved	Percentage Retrieved
Total	657	502	100.0

Source: Authors' work (2020)

4. Results and Discussions

This study is set to examine the impact of information technology on strategy management with emphasis on Iraq banking industry. Regarding the application of IT in banking sector, questions were asked from bank officials. The following: electronic cards, ATMs, online banking, electronic payment, and mobile banking were listed to be the major application of IT in banking sector.

The second objective set to determine the association between education level of bank customers and their usage of IT applications regarding banking transactions. Education indicators are SSCE, NCE, OND, HND/BSc, while banking transactions applied by IT applications with respect to frequency of transactions. This was analyzed with Chi Square test. (See Tables 2 and 3)

Table 2. Contingency table showing the cross tabulation of education level and usage of IT on bank transactions

Education/Usage	HND/BSc (%)	NCE/OND	SSCE	TOTAL (%)
Frequently	15	1.9	1	17.9
Occasionally	10	17	8	35
Rarely	2.1	22	8	32.1
No	4	7	4	15
TOTAL	31.1	47.9	21	100

Source: Authors' Survey

The Chi-Square distribution is a theoretical or mathematical distribution which has wide applicability in statistical analysis. The term 'Chi Square' (pronounced with a hard 'ch') is used because the Greek letter χ is used to define this distribution. It can be seen that the elements on which this distribution is based are squared, so that the symbol χ^2 is used to denote the distribution (Stephanie, 2018; Adeniran, 2018).

The Chi Square statistic is commonly used for testing relationships between categorical variables. The null hypothesis of the Chi Square test is that no relationship exists with the categorical variables in the population; they are independent. Also, it is commonly used to evaluate tests of independence when using a cross tabulation (also known as a bivariate table). Cross tabulation presents the distributions of two categorical variables simultaneously, with the intersections of the categories of the variables appearing in the cells of the table (Adeniran, 2018).

The Test of independence assesses whether an association exists between the two variables by comparing the observed pattern of responses in the cells to the pattern that would be expected if variables were truly independent

of each other (Stephanie, 2018; Adeniran, 2018). In the same vein, χ^2 statistic appears quite different from the other statistics because it can be used for achieving the goodness of fit test and the test of independence. For both of these tests, the data obtained from the sample are referred to as the observed numbers of cases. These are the frequencies of occurrence for each category into which the data have been grouped (Adeniran, 2018).

At 0.05 critical regions (significance level), determine the table value when the Degree of Freedom is $(R-1)(C-1)$. Where R is the row and C is the column. Degree of freedom = $(4-1)(3-1) = 6$. At 0.05 significance level, the degree of freedom 6 gives a table value of 12.59. To compute the test statistics using Chi-square test; $\sum [(O - E)^2 \div E]$

Table 3. Chi Square test

Observed (O)	Expected (E)	O - E	$(O - E)^2$	$(O - E)^2 \div E$
15	5.57	9.43	88.93	15.97
1.9	8.57	-6.67	44.49	5.19
1	3.76	-2.76	7.62	2.03
10	10.89	-0.89	0.79	0.07
17	16.77	0.23	0.05	0.00
8	7.35	0.65	0.42	0.06
2.1	9.98	-7.88	62.09	6.22
2.2	15.38	6.62	43.82	2.85
8	6.74	1.26	1.59	0.24
4	4.67	-0.67	0.45	0.10
7	7.19	-0.19	0.04	0.01
4	3.15	0.85	0.72	0.23

Source: Authors' Survey

Hence, Chi-square test is 32.97. It can be noted that the computed value is 32.97 is greater than table value 12.59; hence, there is a basis to affirm the association between education level of bank customers and their usage of IT applications regarding banking transactions in Iraq. When comparing the observed and the expected lines in the figure, we can deduce that the fitness or goodness between the two lines is fair. This can be attributed to the nature of sample.

The third objective examines the relationship between information technology and organization's strategy in banking sector. Information technology in banking sector was captured with the usage of ATMs and mobile banking, while organization strategy in banking sector was captured with value created and competitiveness among banks. Questions were asked from bank customers on the usage of ATMs and mobile banking. From the survey, it was revealed that 87 percent of respondents do make use of ATMs and 41 percent of respondents do make use of mobile banking option. From the bank officials surveyed, it was revealed that the use of ATMs and mobile banking resulted to bank value creation and competitiveness.

This study confirmed that information technology in banking do enhance strategic management. In fact, banking sector in the 21st century is centred on information technology with high consciousness of all principles in strategic management. Information technology has changed manual system of banking to the use of sophisticated software that even requires highly skilled personnel to handle on the part of the organization while user friendly on the part of the customers. Works that were initially done manually are now done with the use of computer software. This enhances several tasks involving huge steps and numerical analysis to be carried out within the twinkle of an eye.

In reality, banks now communicate with each other and with customers through information technology. What is required is proper networking which is achieved through the linkage of information technology and personal computers from one point to another through fibre optics from central server. Banks can assess and have share customers' data through IT. As a result of this information technology has been recognized as the backbone of banking sector. All the activities in the bank are now dependent on information technology. The funniest thing is that bank entrance is secured by information technology. Data management is not taken crucial as it will be used for prediction of future happenings and critical decisions.

Information technology enhances the manufacture of meaningful information that is used in making effective decisions, thereby fulfilling the mandate of management needs such as problem solving and decision making. Information technology also enhances the quick processing of mathematical and statistical analysis in an efficient manner. It can therefore be affirmed that there is an association between information technology and the management of organization's strategic process. Information technology enhances accuracy, increased productivity, work minimization, efficiency, less wastage, more production, customer retention, customer satisfaction, satisfaction surveys etc. However, the challenge that may arise is ignorance of information technology which may result to fear of job loss.

The study of Ugwu, Oyebisi, Ilori, and Adagunodo (2000) revealed that most bank have their own website on internet to provide users various services which have enhanced transformation from old banking system to modern banking through the adoption of information technology. This study was carried out about 20 years ago. It is pertinent to note that the information technology is changing and not static; hence the impact of information technology on banking sector 20 years ago must have changed in the present era.

The studies of Berisha-Namani (2010), Apulu and Latham (2011), Cakmak and Tas (2012), Madadipouya (2015) agrees with the findings of this study. The study of Berisha-Namani (2010) found that information technology is principally designed to support decision making activities of the management. As the world is drastically changing day by day, it has been evident that no organization can survive without information technology. Apulu and Latham (2011) find that the adoption of IT has huge impact on organizational performance as it is continuous source of growth by increasing efficiency and reducing cost. Information technology enhances efficiency of strategic management in accordance to demand for achieving competitive advantage.

According to Cakmak and Tas (2012), information technology enhances effectiveness and efficiency of strategic management activities which enhances value creation and competitive advantage. It is of no doubt that banks having achieved value creation and competitive advantage which is the aim of strategic management; they have taken advantage of information technology.

In fact, most of the strategies adopted today no longer remains strategic tomorrow because of rapidly changing environment. Among the determinant factors to be considered in the process of strategic management decisions with respect to banking industry are reliability, serviceability, performance, quality of service delivery, ease of usage, durability etc.

Each business has their dynamics of the required IT to be adopted. Madadipouya (2015) stated that IT has enabled diverse organizations to strategically adapt to transformations in business environments. Andersen (2001) also complement that the usage of IT has increased organizational performance, innovation and business profitability, which are all means of achieving competitive advantage.

5. Conclusions

This study has gaudily explored the impact of information technology on strategic management in the Iraq banking sector. The development and spread in technology have reformed many businesses across the world. Banking industry is no exclusion in the revolution. All the commercial banks of developed countries have adopted information technology in their daily business transactions.

The study examined the impact of information technology on strategy management with emphasis on Iraq banking industry. Electronic cards, ATMs, online banking, electronic payment, and mobile banking were the major application of IT in Iraq banking sector. Also, there is an association between education level of bank customers and their usage of IT applications regarding banking transactions in Iraq. Finally, there is a relationship between information technology and organization's strategy which has resulted in value creation and competitive advantage of banks.

Since information technology has drastically changed the nature of olden day banking system. Acceptance and implementation of IT has been proven crucial for the survival of any bank most especially that many bank users are time conscious and preferring electronic banking than old system of banking because of efficient delivery processes, smooth flow of information, better performances, easier transactions. All these are confirmation that IT has positive impact on banking most especially in Iraq. The high level of internet penetration among the populace makes it possible for the drastic acceptance and adoption of information technology in Iraq banking sector. For better performance of IT on banking, the management of banking sector should adopt better policies that will encourage users to adopt IT usage in banks.

References

- Adeniran, A. O. (2016). Impacts of the Fourth Industrial Revolution on Transportation in the Developing Nations. *International Educational Scientific Research Journal*, 2(11), 56-60.
- Adeniran, A. O. (2018). Establishing chi square as a non-parametric test in descriptive statistics. *Science & Technology*, 4, 106-113
- Andersen, T. J. (2001). Information technology, strategic decision making approaches and organizational performance in different industrial settings. *The Journal of Strategic Information Systems*, 10(2), 101–119.
- Apulu, I., & Latham, A. (2011). An evaluation of the impact of Information and Communication Technologies: Two case study examples. *International Business Research*, 4(3), p3.
- Berisha-Namani, M. (2010). The role of information systems in management decision making-an theoretical approach. *Manager Journal*, 12(1), 109-116.
- Breznik, Li. (2012). Can information technology be a source of competitive advantage? *Economic and Business Review*, 14(3), 251-269.
- Cakmak, P. I., & Tas, E. (2012). The Use of Information Technology on Gaining Competitive Advantage in Turkish Contractor Firms. *World Applied Sciences Journal*, 18(2), 274-285.
- Hafaz, N. A., Thurasamy, R., Aziz, N. A., Ali, H., & Khan, M. I. (2019). Modelling the Adoption of Halal Warehousing Services among Halal Pharmaceutical and Cosmetic Manufacturers. *Journal of Sustainability Science and Management* (Vol. 14).
- Hemmatfar, M., Salehi, M., & Bayat, M. (2010). Competitive advantages and strategic information systems. *International Journal of Business and Management*, 5(7) <https://doi.org/10.5539/ijbm.v5n7p158>
- Keen, P. G. (1981). Information systems and organizational change. *Communications of the ACM*, 24(1), 24-33.

Madadipouya, K. (2015). A Review On The Strategic Use Of IT Applications In Achieving and Sustaining Competitive Advantage. arXiv Preprint arXiv:1507.01233. Retrieved from <http://arxiv.org/abs/1507.01233> [10.5121/ijmpict.2015.6202](https://doi.org/10.5121/ijmpict.2015.6202)

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Mugenda, O. M., & Mugenda, A. G. (2003). *Research Methods: Quantitative and Qualitative Approaches*. Acts Press, Nairobi, 2003.

Oluwatolani, O., Joshua, A., & Philip, A. (2011). The Impact of Information Technology in Nigeria's Banking Industry. arXiv Preprint arXiv:1108.1153. Retrieved from <http://arxiv.org/abs/1108.1153>

Reddy, G. S., Srinivasu, R., Rikkula, S. R., & Rao, V. S. (2009). Management information system to help managers for providing decision making in an organization. *International Journal of Reviews in Computing*, 1–6.

Stephanie (2018). Chi Square Statistics in Research. Retrieved on 17th January, 2020 from: <http://www.statisticssolutions.com/using-ChiSquare-statistics-in-research/>

Ugwu, L. O., Oyebisi, T. O., Ilori, M. O., & Adagunodo, E. R. (2000). Organisational impact of information technology on the banking and insurance sector in Nigeria. *Technovation*, 20(12), 711–721.

Uppal, D. R. (2011). Customer Delight—A milestone for the banks. *Journal of Arts, Science and Commerce*, 2(4). Retrieved from http://www.researchersworld.com/vol2/issue4/Paper_2.pdf

Zikmund, W. G. (1999). *Business Research Methods*. Sixth Edition. The Dryden Press Harcourt College Publishers, 389, 1999.

Zuboff, S. (1985). Automate-Informate: The new faces of intelligent technology. *Organizational Dynamics*, 14, 5-18.

Zuboff, S. (1988). *In the Age of the Smart Machine: The Future of Work and Power*. New York: Basic Books

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