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 Tomas Bata University in Zlín  
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**Conference Proceedings**

**DOKBAT**

**16th Annual International Bata Conference  
for Ph.D. Students and Young Researchers**



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**Tomas Bata University in Zlín**

**Faculty of Management and Economics**

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# GREEN HUMAN RESOURCE MANAGEMENT AS A WAY TO SUPPORT SUSTAINABILITY: A LITERATURE REVIEW

*Zuhair Abbas, Muhammad Shoaib, Jana Zlámalová, Roman Zámečník*

## Abstract

Prior researches have paid limited interest to relationship among green human resource management (GHRM) and sustainability. This study aims to contribute to address the research gap in the existing literature of GHRM relating to how sustainability play role in organizations. This study examined systematically the literature on the contemporary and emerging aspect of ecological management of human resources in the workplace and proposed future research programs to meet the needs of organizational sustainability. This detailed literature review has considered a relatively 60 studies published over 13 years, i.e., from January 2008 to March 2020 by using Web of Science and Scopus – aiming to cover studies related to the GHRM research topic. The NVivo Plus version 12 employed for qualitative analysis of articles. This study explored a theoretical model suggesting the meditational role of ‘green transformational leadership along with moderators (green intrinsic and extrinsic motivation) in the correlation among ‘green human resource management practices’ and sustainability. Therefore, it is important that employees and organizations should prioritize economic, environmental and social performance as to ensure sustainable green human resource management.

**Keywords:** *Green Human Resource Management, Sustainability, Content Analysis, Systematic Literature Review*

## 1 INTRODUCTION

Green human resource management (GHRM) practices plays crucial role to promoting sustainability in accomplishment of environmental, economic and social performance. Although, the philosophy of green human resource management has gained huge popularity among the industrial scholars with a sole purpose of reducing the hazards. More importantly, this study aims to find the conceptual relation among sustainability and GHRM practices. In this era of competition, green human resource management and sustainability has gained enormous attention and focus as it has become an instrument of gaining a competitive advantage in terms of developing and deploying the latest competencies of employees. (Khandekar & Sharma, 2005; Ambec & Lanoie, 2008).

Recently there has been renewed interest in the GHRM practices to utilize the resources efficiently which leads to productivity, employee wellbeing, profit maximization and boost the growth of organizations in the industries (Jackson et al., 2011). Another essential point is that most of studies of Green HRM have paying attention more on the business sector. In contrast, there are few studies mainly focused on other sectors, Such as big companies (Haddock-Millar, Sanyal, & Müller-Camen, 2016), healthcare sector (Pinzone et al., 2016), sports complexes (Gholami et al., 2016), and manufacturing industry (Nejati, Rabiei, & Jabbour, 2017; Yong & Yusliza, 2016; Yong et al., 2019a; Yusliza et al., 2019; 2020; Yusliza, Othman, & Jabbour, 2017). In the context of developing countries, a study conducted by Masri and Jaaron, (2017) found that manufacturing companies adopted six GHRM practices i.e. green recruitment, green training, green rewards, green performance, green selection and green culture with strong relationship of sustainability. Interestingly another study by Yong et al., (2019b) indicates that green structural capital has positive relationship with green human resource management.

This study builds on key problems that still remain a matter of serious concern in achievement of goals of sustainability. Recent developments in perspective of sustainability have shown the need for greening the workplace. According to Sehnem et al., (2019), organizations can balance their resources if their business models are aligned under the philosophy of sustainability. The organizations need to collaborate their human resources with the doctrine of sustainability (Singh, 2018). Despite, there are limited studies on GHRM and sustainability in the form of systematic literature review.

This study contributes to address the research gap in the existing literature of GHRM relating to how sustainability play role in organizations. Prior studies neglected the role of leadership and motivation on employee green behaviour. According to Jackson and Seo (2010), there is need for the sustainability with the involvement of human resource management. In the light of research, GHRM field is contemporary in the perspective employee green behaviour (Yong et al., 2019). Skilled and trained workforce is a key requirement to achieve sustainable goals for the companies (García-Carbonell, Martín-Alcázar, & Sanchez-Gardey, 2018).

This study is unique in two aspects from theoretical contributions. First, previous studies have partially examined the green transformational leadership, green intrinsic motivation, green extrinsic motivation and sustainability in the literature. Second, this study provides a less explored research agenda for the future research. One of the biggest challenges for all government, professional and current agencies is sustainability and sustainable development (Olawumi & Chan, 2018). Green human resources practices, such as green recruitment, green training (Pinzone et al., 2019) and green rewards are not only conducive to improving environmental activities but also to the creation of green employees, helping to improve daily behaviour. A green workplace culture will create a safe and secure workplace that will guarantee the health and well-being of employees. However, previous research has demonstrated the ecological and economic benefits of implementing GHRM practices in organizations.

The aim of this study follows the research question and objectives of this paper are to accomplish the following:

*RQ1: What is the role of GHRM and sustainability?*

Research objectives:

*RO1: Identify the most relevant articles describing for green human resource management*

*RO2: Find less explored aspects of GHRM*

*RO3: Provide a trend analysis of GHRM in year wise of published studies*

*RO4: Provide a Word cloud of GHRM from NviVo 12 Plus version Qualitative statistical software*

*RO5: Provide less explored aspects for addressing the major gaps in the current knowledge of green human resource management*

The study is organized into four main areas. First, the theoretical framework that guides the study is discussed, followed by the method used to achieve the results. Thirdly, the results and discussion section are presented followed by the discussion, conclusions and limitations.

## **2 THEORETICAL BACKGROUND**

### **Green Human Resource Management**

GHRM refers to the inculcation and adoption of human resource management practices in aimed at promoting the values of sustainability and conservation of resources throughout businesses and improving environmental sustainability which leads to an increase in employee satisfaction and confidence (Mampra, 2013). The concept of GHRM is not only limited towards the environmental concerns but, it also encompasses the promotion of social and economic well-being of the organization and its workforce (Ahmad, 2015). In recent years, a considerable amount of literature has been published on GHRM and it bring interest to the scholars, policy-makers and leaders globally (Yong, Yusliza, & Fawehinmi, 2019).

The growth and sustainability of businesses throughout the world is mainly attributed to the initiatives undertaken under the umbrella of green environmental management (Daily & Huang, 2001). GHRM takes almost all of its practices from HRM except with the addition and focus on the “greening” of HRM practices. In essence it stresses on the importance of innovation through the organization with the adoption and inculcation of the principles of sustainability, social responsibility, waste minimization and the attainment of competitive edge (Haden, Oyler, & Humphreys, 2009). The onus of the implementation of the afore mentioned practices lies on the HR department of an organization (Jabbour & Santos, 2008a; Foroutan, Timur, & Abubakar, 2018).

The mounting pressure from key stakeholders and industrial scholars has forced the organizations to adopt and draft policies aimed at the accomplishment of social, economic and environmental outcomes. The inculcation of green human resource management practices (GHRM) by the organizations have led to the accomplishment of key outcomes of sustainability such as: social equity, health, well-being of the firm as well as its employees. In addition to this it has also helped in attaining economic stability and environmental equilibrium. According to Lange, (2009) a business can be reestablished from scratch with the exact same modus operandi as before and it can still perform well but the human capital is a key asset which once lost can cause a significant downfall in a business. As per Iqbal, (2018) human resource constitutes the knowledge base of an organization and hence causes the firm to further invest in it considering its future importance.

### **Sustainability**

The term “sustainability” gained global attention after a report published by the World Commission on Environment and Development titled “Our Common Future” (Keeble, 1988). This commission is a subsidiary of the United Nations and is also known as the Brundtland Commission. The WECD equated sustainability with environmental integrity and social equity. As far as the corporations are concerned the term ‘sustainability’ was linked with the concept of sustainable development which focuses on the meeting the demands of the present world without neglecting the needs of the future generations (Keeble, 1988). This concept was widely acknowledged and accepted by the global business community and other stakeholders through the Earth Summit held in Rio de Janeiro in 1992 (Dyllick & Hockerts, 2002). This term underlined the efforts that the organizations need to undertake in order to enhance the social and human welfare and to increase their green footprint in order to ensure the successful accomplishment of the organizational objectives (Sharma, 2002).

## **Green Recruitment and Selection**

The primary goal of organizations with respect to green recruitment and selection is to attract and select such employee who possess values aimed at conserving the organizational resources and promoting sustainable values (Jabbour & Santos, 2008b). The organizational environmental policies aligned with its recruitment strategy can play a key and vital part in attracting talent that possesses green values. With an increase in environmental awareness, the green footprint and environmental image of an organization plays a vital role during the recruitment drives (Renwick, Redman, & Maguire, 2013). The green footprint of an organization can be used as a tool for recruiting suitable talent (Jabbour, 2013). Through the use of web-based channels for recruitment, the organizations can more effectively communicate and portray their environmental footprint to the potential talent as compared to conventional methods such as newspapers, advertisements and brochures (Renwick, Redman, & Maguire, 2013).

## **Green Training and Development**

In order to successfully achieve sustainable development goals, training and development aligned with the principles of “Greening” are considered to be an important aspect for any organization (Pinzone et al., 2019). The talent that is acquired as a result of recruitment can be trained and developed in such a way that it possesses the key elements and values to increase the environmental footprint of the firm (Renwick et al., 2016). A workforce that is motivated around the pretext of environmental sustainability will strive towards the achievement of sustainable goals of the firm (Francis & D’Annunzio-Green, 2005; Rani & Mishra, 2014). In order to attain environmental sustainability, the organizations should take radical measures aimed at successfully integrating all aspects GHRM throughout their core business functions. Besides, the concept of green workforce is a key pre-requisite in order to attain sustainable development.

## **Green Organization Culture**

Organizational culture has gained much importance in the studies pertaining to environmental sustainability as it provides a deep insight with respect to an organization’s sustainability performance. Newton and Harte (1997) have highlighted the importance of organizational culture in studies related to organizational sustainability. On the other hand, Harris and Crane (2002) posit that most of the theories pertaining to organizational greening have been developed on the basis of ostensible evidence. Although the researches operating within the green paradigm have stressed the need for the organizations to promulgate dynamic and swift changes in their cultures in order to effectively cop with environmental challenges and obstacles (Gouldson, 1993). Most findings indicate that the abiding cultures stimulate the adoption of green values by inculcating and adopting them in order to support the cause of environmental sustainability (Fineman, 1996).

## **Green Transformational Leadership**

Transformational leadership is referred a leadership structure under which the leader envisions a desired change and communicates it to the employees while also deploying the tools of continuous inspiration and motivation in order to accomplish that desired change (Avolio, Bass, & Jung, 1999). Such leaders instill awareness amongst the employees through the use and adoption of instruments of fairness, justice, and freedom (Woods, 2007). Leader who possesses a sense of charisma and consideration tend to understand their employees well and also comprehend their needs and levels of motivation. Such leaders communicate a clear vision to their employees and strive to maintain the commitment of the employees towards the

accomplishment of organizational goals (Li et al., 2018). According to Chen and Chang, (2013) green transformational leadership relates to the behavior of a leader who guides and inspires the employees to attain and maintain levels of environmental sustainability and exceed the pre-defined levels of environmental performance.

### Green Intrinsic Motivation

Green intrinsic motivation is something that arises as a result of internal gratification and it is a sort of motivation that induces one to adopt a green behavior. Based on the findings established by Deci and Ryan (2010) we posit that green intrinsic motivation is functional when an employee perceives its underlying cause to have arisen internally. For example, a likeness towards the environments stimulates an employee to develop products that are eco-friendly and are developed keeping in mind the principle of conservation of resources.

In case of intrinsic motivation, a person is driven to do a certain task as a result of an internal stimuli such a love or passion rather than an external factor such as a reward or a benefit (Deci & Ryan, 1985). People who are intrinsically motivated tend to be more passionate, interested and curious, excited to do work, and more engaged and satisfied Amabile et al. (1994). For example, many people love to play golf, gardening and bargaining due to the fact that they feel intrinsically motivated to do so (Amabile et al., 1994). So green intrinsic motivation can be simply called as the “love and passion that drives one to engage in eco-friendly behavior that is induced through an internal stimulus” (Amabile et al., 1994; Deci & Ryan, 1985).

### Green Extrinsic Motivation

Green extrinsic motivation is something that arises as a result of external gratification and it is a sort of motivation that induces one to adopt a green behavior. It is usually induced through an external stimulus such as external rewards, fame, acceptance and acknowledgement, money or grades etc. (Deci & Ryan, 2010). People who possess a higher sense of green intrinsic motivation tend to display more eco-friendly behaviors and feel proud and happy to do so because they are internally motivated. But the provision of extrinsic rewards against the display of such behaviors may reduce the green intrinsic motivation of the employees. According to the componential theory of creativity posited by (Amabile, 1997), many external elements such as rewards, punishments, feedbacks tend to cause a drop in the motivation of the employees to display creative behaviors. Extrinsic motivation causes a decrease in the self-determination and creativity of employees due the presence of excessive external control mechanisms (Hughes et al., 2018).

Tab. 1 – Summary of Relevant Studies on Green Human Resource Management. Source: own research

No.	Authors'	Purpose	Major Findings	Context
1	Ragas et al. (2017)	This study investigates the relationship of green lifestyle in influencing (GHRM) output among employees.	This study shows a green lifestyle plays a modest role in GHRM practice's impact on employee productivity. There is a positive relationship among GHRM procedures into practice and performing jobs.	Diverse kinds of industries, both Local and Multinational
2	Tang et al. (2018)	This study aims to develop and validate GHRM measuring instruments.	The findings of this research would also expand the managers' horizons within an organization. Managers will take all aspects of GHRM examined in this study into consideration in the environmental management process. Managers tend to recruit strong environmental or specialist workers. Because of their green success or organizational actions, these future workers are more likely to trigger environmental problems.	Education Sector

3	Robertson & Carleton (2018)	This study examines internal sites that monitor the indirect effect of management (ETFL) through environmental supporters and the environmental activities of the employees.	The findings of this study suggest that support for environmental partners would enhance the indirect environmental effect of ETFL when workers feel they can affect improvements in environmental performance (i.e., in an internal climate management setting). Plus). Conversely, there is no significant indirect impact of (ETFL) on internal environmental control personnel.	Variety of Industries
4	Bombiak & Marciniuk-Kluska (2018)	This study aims to determine the correlation between the impact on sustainable development of individual human resource practices.	Data research indicates that there is a strong positive connection between the effect on the sustainable growth of the organization of the individual environmental protection staff activities and the effect of implementation. Empirical research shows Poland's idea of handling green human capital is largely unknown. Young Polish companies do not use all the procedures for managing human resources necessary for the successful management of the environment. Hence, green human resource management can be said to be in the early stages of an educational institution's growth.	Young Polish Enterprises
5	Chaudhary (2018)	This article aims to research the effect of Green Human Resource Management (GHRM) (JPI) on potential job searches. The research also explored organizational reputation (OP) as an agent, as a moderator, sexual orientation (EO), and gender relations.	The survey findings support the important relationship between GHRM and JPI, and conclude that OP is the Millennium Relationship Mediator. This study introduces the role of the indirect tool (a tool for fostering transparency in the corporate environment) to provide a possible attitude for employees.	Engineering Institute
6	Jia et al. (2018)	We investigated three factors outside of the organization's scope: transformational leadership, (GHRM) and green spirit of employees to understand the disparities in green innovation of employees.	Our findings give managers a deep understanding of how to get green energy from the employees. "The organization would need to match the green philosophy with its long-term sustainability policy, which will include a high-level GHRM practice program involving green training and development, green rewards and incentive.	Medical Firms
7	Saeed et al. (2018)	The purpose of this study is evaluating the effect on GHRM strategies of employee ecological performance.	Recent findings suggest that green HRM influences environmental actions indirectly through the psychological climate.	Diverse industry sectors
8	Siyambalapitiya, Zhanga, & Liu (2018)	This study aims to bridge the research gap by presenting a research model that is consistent with the GHRM method's theoretical basis that supports environmental efficiency.	The results show that green training and growth have been listed as the most important tasks while addressing green complaints is the least important role. To this end, the second step found in the Green Recruitment cycle by human resources experts.	Tourism Industry
9	Zaid, Jaaron & Bon (2018)	This study examined the relationship between green human resource selection methods and green supply chain management (i.e. external and internal processes) and their effect on sustainability (such as environmental, social and economic performance) at triple endpoints.	The findings show a strong connection between GHRM practice and success on the field. There is also a strong link between the GHRM package program and the effects of the economic performance, which indicates that GHRM and GSCM rely on environmental performance, economic performance and social performance separately. They do not impact GHRM's sustainable output but through the intended mechanism of GSCM practices.	Pollutant Manufacturing Sectors

10	Chaudhary (2020)	This study investigated the role of green human resource management (GHRM) in promoting environmental success for employees.	The findings confirm the positive impact of GHRM on voluntary green actions linked to the job. An important argument is that when mediating the interaction between GHRM and compulsory green employee actions triggered by green work-related actions GHRM would have a greater effect on voluntary green behaviour. The identification of the organization was established.	Automobile Industry
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### 3 METHODOLOGY

This systematic literature review has considered a relatively 60 studies published over 13 years, i.e., from January 2008 to March 2020 by using Web of Science and Scopus – aiming to cover studies related to the GHRM research topic. According to Moher et al. (2010), this study employed Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) a typical technique of literature review. A literature from Web of Science and Scopus databases were mostly used in these articles. A lot of relevant articles have recommended an equivalent number of articles for the purpose of systematic literature review (Lage & Godinho Filho, 2010; Van Kampen, Akkerman, & van Donk, 2012).

This study has not yet been effectively and holistically applied to the field of green human resource management. The use of NVIVO Plus 12 was deployed in order to undertake a content analysis of the articles reviewed for the purpose of this study. The keywords were used to find the articles that are usually mentioned in the research title, abstract and the text of the research paper. Some common keywords used for the purpose of searching relevant articles include: “green human resource management”, and “sustainability”. In order to enhance the probability of successful search results a combination of these keywords along with other relevant terminologies was also used. Initially the queries were entered in the ISI Web of Knowledge and Scopus databases. The below mentioned Figure 1 shows the process of data from numerous articles through search of literature.

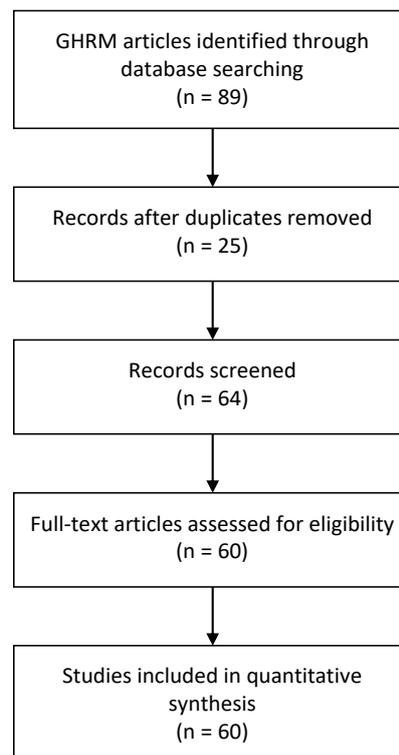


Fig. 1 – Systematic Literature Search. Source: own research

## 4 RESULTS

This trend analysis (see Figure 2) indicates the rise on green human resources studies from 2012 to 2019 due to policy makers, leaders and managers focus on environmental issues and climate change in the world. Scholars are concerned about this contemporary issue and emerging field to implement the green practices as neutralize environmental issues and reduce costs for organization and take care of the society.

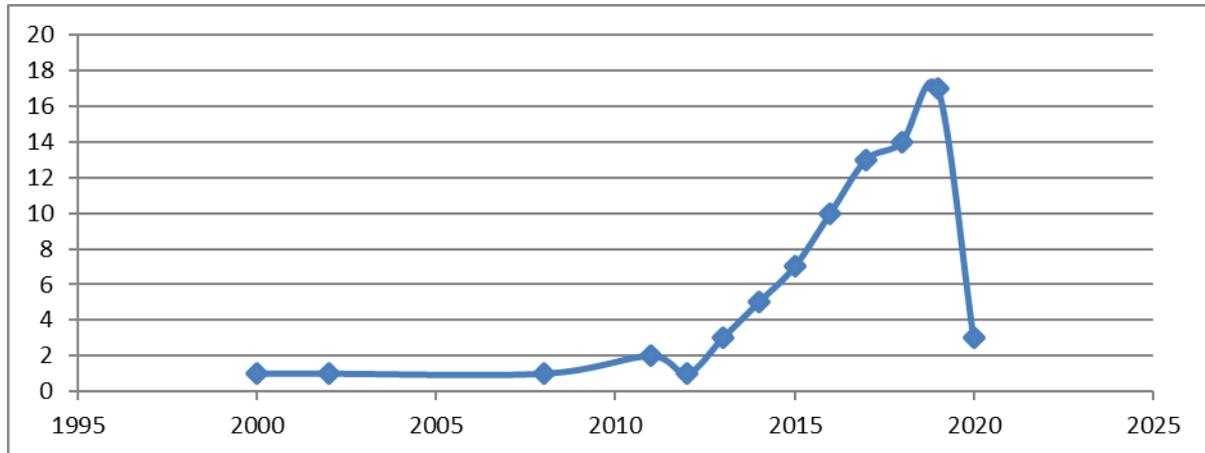


Fig. 2 – Number of Articles Published in Year on Green Human Resource Management. Source: own research

However, quantitative research will be carried out to complete this study. Here it is as the current theoretical framework model (see Figure 3) was based on concrete evidence from the peer-reviewed literature; the heart of this study is the testing of the model for further theory development. In addition, in other cases, to validate existing research hypotheses, it is necessary to collect sufficient statistical evidence from the target audience.

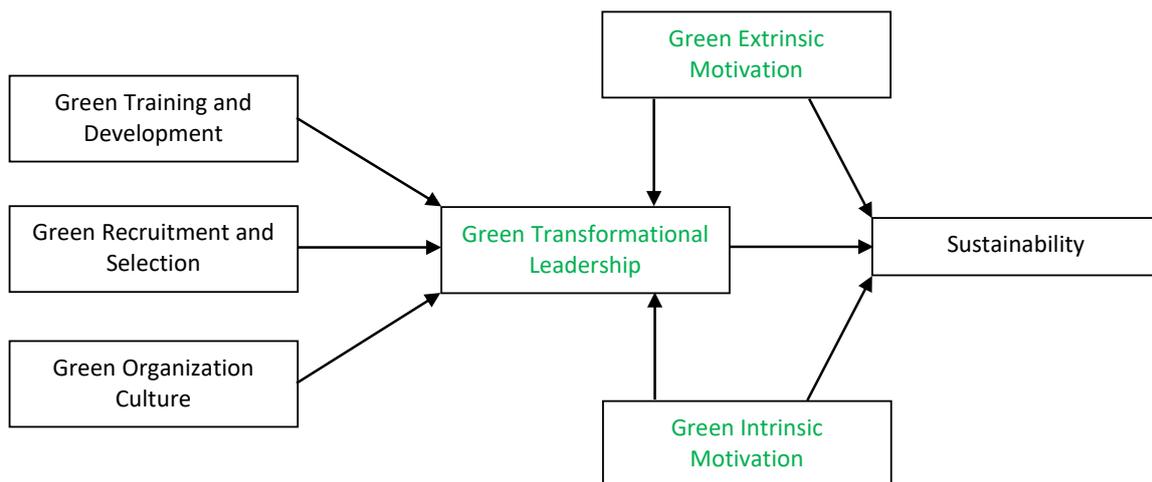


Fig. 3 – Theoretical Framework. Source: own research

This study generated output in the form of world cloud by applying NVivo and mostly occurring words were identified from 60 core publications in GHRM. The Figure 4 shows the words ‘environmental’, ‘green’, ‘managing’, ‘practicing’, ‘sustaining’, ‘resources’, ‘GHRM’ were found to be frequently used during the chosen articles.



## Limitations and Future research agenda

This study has two limitations, firstly, this study only considered quantitative studies. Secondly, this work is purely literature review. It cannot be justified therefore empirical studies will be required to test the model. Future research explores both quantitative and Qualitative studies on GHRM. In addition, future research may view the GHRM with the relation of leadership in implementation of environmental policies at the workplace. Future research also explores the green intrinsic motivation and green extrinsic motivation as moderator variables. Future research should also use top management commitment as mediator variable to get the perspective of top management on environmental policies of companies at the workplace.

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# ASSESSING MARKET ORIENTATION IN THE FACE OF A PANDEMIC

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## **Abstract**

Organizations are increasingly faced with the challenge of exceeding customers' expectations in the provision of products. This is even much more pronounced in a turbulent business environment and the wake of uncertainties such as pandemics. There is a need to adopt the best strategies possible to survive in the competitive landscape. This paper discusses the concept of market orientation and analyses its importance to business in the face of this new coronavirus (COVID-19). The paper also explored the implications of business support/non-support for market orientation and finally draws some conclusions while providing implications of the adoption of appropriate marketing strategies in a bid to cope with this pandemic. This review used search engines including Elsevier and google scholar to compile the relevant literature using all related and appropriate search terms. The review strengthens the extant literature on market orientation especially during a pandemic by highlighting business support for it and the appropriate strategies that organizations can use during a pandemic. Organizations are challenged to be both proactive and responsive where an uncertain crisis may occur. They must develop and implement strategies that best fit customer prioritization even out of pandemics. It concluded the discussion with future research directions.

*Keywords: market orientation, pandemic, COVID-19*

## **1 INTRODUCTION**

Market orientation (MO) is the implementation of the marketing concept (philosophical foundation) which involves the identification of consumer needs and wants through market research and development of the needs and wants to satisfy the target market in a profitable way as against competitors (Kohli & Jaworski, 1990). Market orientation has been originally defined as either a process (Kohli & Jaworski) or as organizational culture (Narver & Slater, 1990). The orientation of Narver and Slater conveys that organizational resources, objectives and culture is geared towards the creation of value and satisfaction for the consumer; hence it becomes an organizational culture supported by its structures. Traditional, customers are the primary focus of MO; when an organization is market-oriented, it is more aware of the expectations and needs of its customers and satisfies them (Micheels & Gow, 2012). In a simpler explanation, MO refers to collecting data on current and future customers and competitors and disseminating same across the various organizational departments to analyze, understand the market and respond by creating value to the customer effectively and efficiently as compared the competition in the market (Narver & Slater). This presents a proactive way of satisfying the customer and this has made MO a relevant topic for business which wants to create unique value for its customers. Organizations with MO have a better understanding of the target market needs and wants, the existing capabilities of its market competitors and general external environmental forces as compared to organizations without MO. And so, they can better respond to customers' needs and preferences resulting in higher performance by that organization.

Extant literature has touted MO as an important antecedent to but not limited to organizational performance for-profit and not-for-profit organizations (Powers, Kennedy, & Choi, 2020;

Kumar et al., 2011; Wood, Bhuian & Kiecker, 2000; Jaworski & Kohli, 1993; Narver & Slater, 1990), new product development and performance (Zhang & Duan, 2010), innovation (Alhakimi & Mahmoud, 2020; Liu & Huang, 2020) as well as a competitive advantage (Tajeddini & Ratten, 2020; Kumar et al., 2011). The market research is conducted to solicit market intelligence to identify, develop and use customers' knowledge to improve the organizations business portfolio which influences their competitiveness with other competitors in the industry. Covid-19 has brought a shock to the world market and has shaken the foundations of marketing. Organizations and consumers have been affected greatly due to the huge turbulence it has caused the commercial market. The question is whether being market-oriented will be of significant help to businesses especially in such a turbulent and unpredictable time in business. This review sought to draw from extant literature, how MO has benefitted organizations, and also delve into the issue of how relevant MO is in Covid-19, a pandemic which has shaken the foundations of marketing and business operations.

## **2 THEORETICAL BACKGROUND**

### **2.1 Theory of Market Orientation**

According to Narver and Slater, market orientation refers to an organizational culture which propels a behaviour that promotes the creation of superior value for the customer effectively and efficiently. They projected MO as a content-driven perspective with three dimensions consisting: customer orientation, competitor orientation and inter-functional coordination. Customer orientation involves gathering of information on customers' needs and wants and responding by satisfying these needs and wants. Traditionally in marketing, customers are the driving force for every business setup. Without customers, businesses cannot exist. Before any product or service is introduced, market research is done to assess what customers need and deem satisfying. The product or service design is also highly dependent on customer inputs. After some prototypes are produced, some percentage of the target customers have the opportunity to test the concept and give feedback to the organizations for further enhancements or further test marketing. Hence, gathering information on customers is the foremost important factor in being successful at selling an organization's designed products and services. According to Porter (2008), every organization has a relevant external environment which includes but not limited to social, economic and competition. However, the most unpredictable which resides in the industry which the organization finds itself is competition. Additionally, every competing organization has a competing strategy. Although there may be rules governing competitive strategies, competitors remain unpredictable. For an organization to be ahead of its competitors, it may need more information on its competitors to identify threats of substitute products, bargaining power of their suppliers and buyers, threats of new entrants and finally the continuous rivalry among existing competitors (Porter). Organizations can inculcate this information on competitors in their planning and strategy formulation to improve their product development and design and present unique value to their target markets. Finally, inter-functional coordination refers to the dissemination of information gathered on customers and competitors and the continuous collaboration among all functional areas. This will give the functional areas a clear understanding of organizational strategy and encourage their support for its achievements.

On another process-driven perspective, Kohli and Jaworski (1990) defined MO as an organization-wide generation of market intelligence relating to both current and future customers need and preferences, dissemination of such information across all functional departments in the organization and the organization's response to such intelligence. Further, Day (1994) defined MO as representative of superior capabilities in understanding and

satisfying customers' needs and wants. There is a common ideology of the customer being the "centre of attraction", hence information on them is gathered to form the basic component of innovation. Also, the focus of the organization is basically on its external environments more than the internal (for example the customer and competitor orientation). The gathering of relevant information on them and disseminating the same among all departments in the organization to generate a unified response. It is important to rally the support of the whole organization to stay competitive while satisfying the customers. The creation of value as a response to the information gathered is also a common element in these definitions. The definition of Kohli and Jaworski and Day are captured in the definition by Narver and Slater although. However, this research operationalizes market orientation consistent with Narver and Slater's (1990) framework. Further, Kohli and Jaworski (1990) contend that the greater a firm's market orientation, the more likely they are to produce product/service offerings tailored to fit a market segment's specific tastes and preferences.

Every business exists in an environment which they affect or are affected by them. Environmental factors of any business environment are likely to impact the level of MO. Hence, in their work, Market orientation: Antecedents and consequences, Jaworski and Kohli (1993) touted market turbulence as a strong moderator between MO and firm performance. Market turbulence refers to the "rate of change in the composition of customers and their preference" (p.57). In effect, market orientation manifests itself automatically in organizations that work in more turbulent markets such as this pandemic, hence, businesses have the duty of altering the products and services continuously to satisfy the changing needs and preferences of the customers. Covid-19 has shaken the business environment and has adversely affected all business sectors. The market has become unpredictable with a recognizable change in consumer taste and preferences over this short time. Businesses are constrained as to the best strategy to implement to survive in this pandemic. It can be argued that a market-oriented firm is more likely to achieve high levels of performance in a turbulent market through customer satisfaction, retaining existing customers, and attracting new ones. This will automatically improve the desired levels of growth, market share, and, subsequently, profitability, because, businesses that are strong in customer orientation have a higher chance of achieving superior performance (Greenley, 1995).

### **3 METHODOLOGY**

An extensive literature on market orientation exists in the field of marketing. The authors focused on the literature on market orientation and its consequences published in English. Several unique papers have focused on the consequence of market orientation and especially on turbulent markets. A survey of the literature was carried out and compiled from search engines including ScienceDirect, and google scholar using keywords such as market orientation, the effect of market orientation, consequences of market orientation, MO and turbulent markets, the business response in Covid-19 and other related terms. We also included other articles from searches of the reference section of the initially downloaded paper. All the papers used for this review were published in reputable scholarly journals.

### **4 DISCUSSION**

#### **4.1 Benefits of MO to businesses**

Several empirical kinds of research have established a significant and strong relationship between market orientation and several measures of business performance including but not limited to profitability, customer retention, growth in sales, market performance and new product success (Narver & Slater, 1990; Jaworsky & Kohli, 1993; Deshpandé, 1999; Daneels,

2007). It has, therefore, been generally accepted that market orientation has a positive influence on the performance of firms. This relationship has not only been firmly established for large firms but also has been found in research on small and medium-sized firms (Pelham, 2000). Although various conceptualizations of market orientation exist in the literature (Jaworski & Kohli, 1993; Narver & Slater, 1990), the construct is of significant value due to its link to business performance. By being market-oriented, a firm can keep existing customers satisfied and loyal, attract new customers, accomplish the desired level of growth and market share and, subsequently, achieve desirable levels of business performance (Homburg & Pflesser, 2000).

Market orientation has been studied mainly as a determinant of business performance (Avlonitis & Gounaris, 1999; Dawes, 2000; Matear et al., 2002) and innovation (Agarwal et al., 2003; Manzano et al., 2005). However, inconsistent findings have been reported. Several studies report a direct and positive effect (Avlonitis & Gounaris, 1999; Deshpande & Farley, 1998; Jaworski & Kohli, 1993), others have examined a mediated relationship (Baker & Sinkula, 1999) and finally, the third stream of research tested a negative link (Pelham, 1997) between market orientation and business performance. In an extensive review of related literature, the majority of the studies (68%) investigating a direct relationship between these two constructs reported positive effects, others (30%) found no effects, whereas a small number (2%) indicated negative effects (Langerak, 2002).

A substantial volume in the literature reveals that market orientation is associated with subjective performance and specifically with both the degree of long-run financial performance and short-term profitability, expressed as return on assets (Hooley et al., 2001), market growth rate and sales growth (Dawes, 2000). However, objective measures of performance such as gross operating profit, market share and capacity utilization have been also found to be related to market orientation (Agarwal et al., 2003). Moreover, being market-oriented constitutes the strongest discriminating factor between high- and low-performing businesses (Ruekert, 1992). Although the realization of the marketing concept is not considered the sole responsibility of the marketing department, recent academic works have examined its impact on market performance. Hence, it has been found that market orientation is positively associated with service quality, customer satisfaction (Agarwal et al., 2003), customer trust (Pelham, 1997; Siguaw, Simpson, & Baker, 1998), brand equity, corporate reputation/ image (Matear et al., 2002) and new product success (Slater & Narver, 1994). The conceptual model proposed by McNaughton et al. (2002) postulates market orientation as the foundation for accomplishing market-based assets, creating value for customers and shareholders and attracting/retaining customers. Market orientation is also considered as a catalyst in the implementation of specific marketing strategies. Dobni and Luffman (2000) have reported that firms with strong market orientation engage in value creation strategies such as market segmentation, developing new products/services for new markets and product or service customization. Furthermore, to understand how market orientation impacts performance, researchers investigated several possible mediating factors such as innovation and customer relationship. Increasing evidence has linked market orientation to innovation. However, it is not clear yet whether innovation acts as a moderator and/or mediator on the relationship between market orientation and firm performance (Agarwal et al., 2003; Manzano et al., 2005). Thus, one would say that being market-oriented in this time of pandemic will help reduce the anxiety of customers and could also have a long-term effect on the relationship customers will develop with businesses. The ensuing sections discuss business support/non-support for MO during a pandemic and some conclusions and implications.

## **4.2 Business support for MO in a pandemic**

The World Health Organization (WHO) declared Covid-19 a pandemic on 11th March 2020 when the number of confirmed cases reached 118,000 in 114 countries and with 4,291 recorded deaths. WHO director-general cited this as the first pandemic that has been caused by a coronavirus, and it is not only affecting the public health but every sector of the world economy. The COVID-19 disease is caused by a virus known as SARS-CoV-2 causes mild illness including cough, fever, shortness of breath and sudden onset of anosmia, ageusia or dysgeusia (as of 29th May 2020), although it can be fatal in some instances (older patients and patients with underlying conditions). As of 7th July, WHO reported 11,425,209 confirmed cases, 97,419 new cases, 534,062 confirmed deaths all recorded in 216 countries (WHO, 2020). Businesses have suffered greatly due to this pandemic. Their business operations have changed to satisfy changing consumer needs and preferences during this pandemic. While some businesses anticipate a continuous operation and increase in sales and revenues due to the type of product and service they offer, others anticipate a negative change in the demand of their products and services, operations, revenues and even operational costs. Indeed, not all business strategies may work in turbulent markets as we have during this pandemic. There is a world economic crisis causing major shifts to consumers and business managers alike. In the view of Crick and Crick (2020) and Cortez and Johnston, (2020), COVID has brought shocks as well as huge changes to the way business is done, thus demanding employees to work from home but increasing the demand for deliveries of essential products to homes.

Consumer purchasing decision has been severely altered because of the break-in B2C market. Consumers, during the lockdown, had to rely overly on the patronage of services of delivery firms. They were constrained on consumer choice and had to adjust to products and services they may have never used under "normal times". There was increased demand for grocery items, panic buying and most importantly stockpiling of items consumers deem a necessity and all these increased consumer spending (Chronopoulos, Lukas & Wilson, 2020). Most businesses run low on inventory for goods that were stockpiled by consumers, there were changes in tactical and operation plans, increase in operation costs, alter advertising strategy (Gao et al., 2015) and include safety protocols proposed by WHO and even institute the work shift system to reduce overhead costs. Some budgets and investment plans had to be withheld or cancelled entirely, some production houses had to reduce production and lay off employees, airlines laid off some technical and operational staff too. Larger organisations may be able to withstand this shock but small businesses may not stand this test of time. In all these, the customer is still the focus, creation of value in this trying time. Issue of survival becomes key at this moment which is highly related to how competitive the business is. This makes MO still very relevant even in a turbulent time as this.

### ***Customer orientation***

MO primary focus on the customer is very important. As rightly argued by He and Harris (2020), Covid-19 presents businesses with an opportunity to be genuinely concerned and contribute to issues of Corporate Social Responsibility (CSR). Customer orientation in MO according to Slater and Narver (1998) is characterised by a customer-focused culture which advances the needs of customers as an organisation-wide agenda (internal efforts) and creates superior value for the customer while it becomes a strategic focus for the organisation. When an organisation is customer-oriented, it focuses on both its current and future customers by soliciting intelligence (empirical evidence) to understand their preferences which will inform their product and service development and design to satisfy these customers efficiently. During Covid-19, customers were challenged to make an ethical decision on businesses who supported socially responsible behaviours and also based on trust for such businesses. Businesses got

basic market intelligence through consumer online searches and orders. They had to rely heavily on courier services which were charged on the consumer. Indeed, the customer is the focus of every business operation, hence the strategic focus on customers paid off for organisations which sought better and transformative ways to satisfy their customers. Economically, Covid-19 has affected customer demands; either reduced demands or shifted demands to substitute products, businesses who do not adopt technological initiatives may be impeded in their quest to retain customers. Although governments may support to defray some overhead costs, business performance will be greatly affected and this may even affect the organisations sustainable initiatives. However, businesses should strive to build a stronger customer relationship through technological advancements which will influence customer acquisition, development and even retention.

### ***Competitor orientation***

Competition is important for every business. Organisations that are considered customer-oriented advance the needs of its customers but this adopted culture does not succeed without facing competition. Hence, MO is an important business culture which attempts to satisfy customer needs and preferences better than competitors. Competitor orientation was defined by Dev, Zhou, Brown and Agarwal (2009) as the ability of an organisation to gather intelligence on its competitors to understand their strengths and weaknesses in the short-run while considering their long-term strategies which will inform the marketing and competitive strategy the organisation should adopt. Organisations may use this intelligence to create a differentiated marketing campaign which will appeal to the target customer. An organisations creativity and innovativeness come to play here because they have all the empirical data on their competitors. Covid-19 brought competition as every commercial organisation needed to sell to settle costs of business operations and survive. Although competition exists, its intensity during Covid-19 was not the focus for organisations; the customer was. However, there could be coepetition among organisations as suggested by Crick and Crick (2020) although with much caution and an aftermath assessment after Covid-19 is over.

### ***Interfunctional coordination***

According to Narver and Slater (1990), inter-functional coordination refers to a culture which integrates and collaborates of all the functional departments in an organisation to enhance information dissemination to achieve value for the customer and achieve organizational goals. The abilities and capabilities of the various functional departments inform their inputs which are evaluated in the organisation's interest to produce better-informed decisions while championing the goals of the organisation. As posited earlier, this dimension under MO is based on communicating and disseminating of intelligence, and the exchange of ideas on the functional department-level in the interest of the organisational goal. Amabile and Pratt (2016) rightly argued that coordination among functional departments in an organisation may stimulate creativity and innovativeness. The most important occurrence during Covid-19 for those organisations that did not shut down during the lock-down was coordination among departments. Panic buying and stockpiling by customers caused high levels of shortages and the ultimate solution was a constant communication among all the functional departments for stock control and inventory. Online shops would have a similar structure to manage inventory. Communication and collaboration among functional departments with different functional expertise, experience including education, will allow for flexibility and adaptability (because of trust and commitment) to crisis management strategies initiated by businesses. Conflict and misunderstandings during this pandemic may cost the business and its survival.

## 5 CONCLUSION

The implications are not inconsequential as the world has moved to an economic system where prioritizing the customer is necessary for survival. The uncertainty that arises from crises show that businesses should not only be proactive but also reactive. Being reactive means that appropriate strategies would have to be adopted to be able to handle crises well. COVID 19 has come with its opportunities as well as challenges. The question is whether a business should provide support for an organization-wide culture of being market-oriented or not. In the last few months, businesses have had to be more protective by focusing attention on their businesses, employees, and customers. In this same period, due to lockdowns, most people have resorted to social media and the internet to obtain relevant information on products. Again, the rise in demand for physical goods has also increased the pressure on businesses to obtain new or additional channels to meet customer demands. To be market-oriented means the businesses would have to provide accurate information to customers on how the company is handling the pandemic, and this could be done through communicative videos and audio-visuals. Again, since customers stay online for longer periods, there is a need for businesses to move their brands online to stay connected to their customers. To support MO strategy during a pandemic means that business should craft and keep attractive themes of their marketing content online. This could be done by leveraging on key social media and internet tools for important topics that will provide information and insight on what customers may be seeking for. Further, businesses need to use the appropriate marketing communications tools to communicate regularly with customers and the entire value chain. It is evident that today's customers seek to do business with organizations that go beyond just arm's length transactions to a relational one. Thus, there is the need to infuse both reliability and empathy in their marketing communications programmes since what customers desire is right information that will help satisfy their needs and not businesses taking advantage of their situation. Future research could consider exploring MO in both small businesses and large businesses to ascertain its empirical impact on their performance and crisis management strategy during Covid-19.

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# CUSTOMERS' SHOPPING BEHAVIOUR IN OGS: CHANGES CAUSED BY COVID-19

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## **Abstract**

We can consider the COVID-19 pandemic to be the latest and most significant situational factor influencing customers' behaviour when purchasing grocery online. The question is how this factor influenced these customers. Therefore, the paper aims to determine the impact of the COVID-19 pandemic on customers' shopping behaviour and perceptions of online grocery satisfaction. Comparative research using an online questionnaire was chosen to obtain relevant data. The data collection was performed before the declaration of a state of emergency (n = 773) and after its cancellation (n = 195) in the Czechia. One of the main results of the research is the finding that every second respondent has changed the shopping behaviour in connection with the pandemic directly. A total of 16% of customers began to prefer OGS as a way to avoid the risk of infection they felt offline. It was found that the trend of grocery stockpiling was also reflected in the online environment, where 5% of customers started buying much more grocery than they were used to. Based on the results it is evident that OGS will become new-normal, because "after pandemic' customers" decide to continue shopping even after the pandemic mitigation. It can be estimated that up to 63% of individuals in the Czechia will buy grocery online in 2020, which shows a much faster acceptance of this shopping channel than predicted. The identified structural changes suggest that another stage of development - digitalization, has already taken place in grocery retail.

**Keywords:** *online grocery shopping, customers, behaviour, customers' satisfaction, service quality, stockpiling*

## **1 INTRODUCTION**

At the beginning of 2020, few expected that borders could be closed and the supply chain disrupted in connection with Covid-19 (a disease caused by a newly discovered coronavirus in 2019). However, once the World Health Organization declared the SARS-CoV-2 coronavirus epidemic (11. 3. 2020), causing Covid-19 in the wake of the pandemic (WHO, 2020), global government action had taken off rapidly, and some countries were gradually closing themselves off from the outside world. This situation has led to changes in customers' behaviour. The most visible of which has been the accumulation of stocks and their shortage due to the interruption of retailers' supply chains. However, changes in grocery shopping were not evident only in the traditional offline environment but were also visible within the online environment (Robertson, 2020), as pandemic pushes customers online.

The research provided in the USA by consulting firm Brain & Company found that only 3% or 4% of grocery spending in the U.S. was online before the pandemic, but that's surged to 10 or 15% (Repko, 2020). The unpreparedness of online grocery retailers for a significant increase in sales in such a short period was reflected most in the insufficient number of delivery slots for customers due to the inflexible logistics and distribution system and facilities. Another problem was the accumulation of stocks by customers, which resulted in the sale of some types of goods in the online environment.

This research focuses on the impact of global pandemic (Covid-19) on perceived customer satisfaction with online grocery shopping (OGS) and their shopping behaviour. The current

situation is compared in terms of differences in the perception of the service of retailers operating in the online grocery market by its customers before the onset of this pandemic and after the release of government measures associated with resolving this pandemic in the Czechia. The research was therefore carried out before the declaration of the state of emergency and shortly after its cancellation so that at the time of the research, new strategies were already being implemented by companies to overcome this period.

The aim is to determine the impact of the COVID-19 pandemic on customers' shopping behaviour and perceptions of online grocery satisfaction. Due to situational factor, it was determined whether customers began to buy grocery online, or otherwise changed their shopping habits and whether they will continue to buy grocery online after pandemic mitigation. Part of the research was also to find out which companies respondents buy grocery online. Then the overall satisfaction with this retailer was examined as well as satisfaction in specific attributes related to buying grocery online. These attributes included loyalty programs, special discount offers, grocery options offered, delivery options, delivery price, quality of grocery delivered, prices of grocery offered, ease of purchase via the website and ease of purchase through the application.

## **2 THEORETICAL BACKGROUND**

The beginnings of online grocery shopping are associated with companies doing business only in the online market. The late 1990s were a time of great optimism as customers slowly began to order products online, with the idea that this new way of shopping would be completely revolutionary for the industry (Saunders, 2018). However, due to the high costs of logistics, warehousing and marketing, this type of company failed very quickly in this market and online grocery shopping began to be considered a digital frenzy (Tedeschi, 2002). Later, larger established grocery chains entered the online market and began to expand their offerings more aggressively in the online environment. Selling grocery online has suddenly become an interesting category again with lucrative sales forecasts. In 2016, the global online grocery market generated approximately \$ 48 billion in sales, but by 2018, sales were twice as high (Statista, 2020a).

Globally, it was estimated in 2016 that the development of online grocery shopping would exceed \$ 150 billion in sales in 2025 (Statista, 2020a). However, the aftermath of the global Covid-19 pandemic shows that online grocery sales could exceed \$ 150 billion in sales much earlier than estimated due to a 40% increase in industry sales in the United States compared to 2019 (Redman, 2020). Besides, based on research conducted by Nielsen in 2018, it is likely that by 2024, up to 70% of customers will be buying grocery online (Nielsen, 2020), with a significant increase in the number of customers due to a pandemic in the sector already visible. For example, a survey conducted before the US pandemic found that 74% of respondents thought they could buy grocery online if they had to stay home due to a pandemic in March 2020 (Statista, 2020b). These estimates are confirmed by research conducted after the outbreak of the pandemic, in which almost a quarter of respondents worldwide shopped online for grocery before March 1, and another 18% said they bought grocery online directly as a result of Covid-19; although older households used it less before and after the pandemic (Beck & Heshner, 2020). In this context, retailers of groceries experienced increased demand opportunities for serving consumers at home, while facing challenges of inventory, supply chain management, delivery, and keeping their facilities a safe environment (Roggeveen & Sethuraman, 2020).

## **Changes in customers' behaviour on the online grocery market**

One of the government's measures to prevent the spread of Covid-19 was lockdown, which had a direct impact on securing cross-border processes in the supply chain. Even before the announcement of the lockdown, many people began to panic and buy and store products such as water, gloves, pasta, canned food, hand disinfectants and toilet paper (Mao, 2020). Under normal circumstances, customers purchasing grocery online would probably not be able to find that there has been a supply outage and the demand for goods would be met by the wholesale insurance stocks. However, due to the media-generated panic and the speed of WOM on social media, there was a change in the behaviour of some customers who began to stockpile selected goods, which resulted in their sold-out. This media panic also affected a group of adolescents, of whom as many as 19% were engaged in stockpiling behaviour in the United States (Oosterhoff & Palmer, 2020).

The supply chain was probably no longer able to cover from the insurance stock both the supply outage itself and the unpredictable increase in customer demand. This situation is related to the most common problems when purchasing grocery online that began to appear during the onset of the pandemic, which is overbooking, late deliveries, or undelivered goods (BBC, 2020a). Stockpiling is very dangerous concerns due to situation when vulnerable populations who cannot afford to stockpile, may not find grocery (BBC, 2020b).

Overall, customers moved to online grocery shopping due to Covid-19, which has been particularly notable given the share of online purchases made by households that have not traditionally purchased groceries online before the pandemic (Charlebois, 2020; Husain & Ashkanani, 2020). Downloads of grocery apps have doubled during a week when the WHO officially declared the Covid-19 as the pandemic (Perez, 2020). Thus, the number of customers buying grocery online has increased very rapidly worldwide during the early stages of the government-imposed nation-wide lock-down, for example in China more than 30% of customers buy grocery in this way (Li, Hallsworth & Coca-Stefaniak, 2020). The pandemic has accelerated the structural changes (Kim, 2020), which are evident in grocery retailing field as well. Richards and Rickard (2020) predict that change of the way how consumers purchases grocery is a potential long-term trend that may emerge from the COVID-19. Also, other researches (Hobbs, 2020; Goddard, 2020) predict the long-run changes in grocery supply chains as the effects of demand-side shocks and potential supply-side disruptions caused by the pandemic. Hobbs (2020) assumes the growth of the online grocery delivery sector and the extent to which consumers prioritize local food.

These changes in the frequency of online grocery purchases and the number of customers buying grocery online have been caused by the outbreak of Covid-19, which by its nature can be classified as a situational factor. Situational factors are an important trigger in the acceptance of online grocery purchases and are an unbalanced adoption process that is based on circumstances rather than cognitive processing and decision-making (Perea Monsuwé, Dellaert & Ruyter 2004). For situational factors, it is common for customers to return to their original behaviour after they disappear (Hand et al., 2009). Thus, if a customer starts buying grocery online because he has broken his leg, then after his recovery, he starts buying grocery again in an offline environment, as before his injury.

However, the situational factor associated with Covid-19 may have a longer-term effect on customers, as the disease may not resolve completely and will still be present in the population. Due to the education of customers about the spread of the virus by governments, some customers may also begin to perceive buying grocery online as a safer form of obtaining grocery, where it is possible to avoid large groups of customers in one place. Given this, the following hypotheses were formulated:

*H1: One of the positive consequences of the Covid-19 pandemic was the impulse leading to faster acceptance of online grocery shopping.*

*H2: Customers perceive purchasing grocery online as a safer form of obtaining grocery in the event of a Covid-19 pandemic.*

Another change is the shift in perception of price and brand. Within certain categories of goods, customers found themselves under time pressure when buying, as quantities of these goods were quickly sold out. This time pressure caused customers to start buying more expensive products than they were used to, as well as much higher quality product brands (Bialkova, Grunert & van Trijp, 2020). If the behaviour of customers for individual products within brands has changed, could the perception of specific retailers in online grocery shopping also change? If so, by analogy with the likelihood that customers may perceive the online environment as safer to shop during the pandemic, satisfaction with these online grocery retailers should also increase. Given this, the following hypothesis was formulated:

*H3: Satisfaction with TOP 3 online grocery retailers has increased as a result of the Covid-19 pandemic.*

Due to Roggeveen and Sethuraman (2020) is likely, some of the new behaviours adopted by retailers and consumers during the pandemic may become the new-normal, therefore it is very important to anticipate what these changes will mean for the retailing after the pandemic and include them to the retailers planning process. Richards and Rickard (2020) confirm the previous prediction as they see the potential impacts relates to Covid-19 on the grocery market in structural changes in the industry that may undergo fundamental, and larger irreversible shocks, such as consolidation and a move toward online shopping.

### **3 METHODOLOGY**

Comparative research was conducted to compare the perceptions of customer satisfaction with grocery purchases online before and after the outbreak of the Covid-19 pandemic. The first part of the research was carried out in January 2020 and the second part was carried out in June 2020. The research was based on a questionnaire survey using the method of questioning via the Internet. This method was chosen precisely because it makes it possible to obtain a large sample of respondents that are geographically dispersed (Saunders, 2018).

#### **Research design**

Primary data from January 2020 were collected through the IPSOS agency and the research was carried out in the Czechia. Respondents were selected from the online panel of respondents of the IPSOS agency, which is certified and control mechanisms are used to guarantee quality data, which are currently beyond the framework of SIMAR and ESOMAR standards. The primary data from June 2020 were obtained mainly through self-collection through online discussions and forums focused on online grocery shopping and grocery shopping in connection with the consequences of the COVID-19 pandemic. To obtain a larger number of respondents, the combined students were also contacted via the university's e-mail directory. Students could answer the questionnaire only if they had ever bought grocery online. Also, the second part was a semi-open question examining the effects of the pandemic on the customer' behaviour.

During the process of cleaning the data of the sample of respondents from January 2020, 146 questionnaires were excluded from the total number of 939 collected responses based on logical control (using the question whether the respondent has ever purchased grocery online). Moreover, 22 respondents were excluded based on analysis using standard deviation. For the

subsequent testing of data using selected mathematical-statistical methods, a sample of 773 respondents was determined by this process.

The second sample, which was from June 2020, contained 234 respondents. Based on a logical check (using the question of whether the respondent has ever bought grocery online) and an analysis using the standard deviation, 39 respondents were excluded. Through this process, the final second sample included 195 respondents.

### Data characteristics

The sample is characterized by several factors. Specifically, in terms of demographic (gender, age subsequently passed on to generation, number of household members), socioeconomic (income) and behavioural differences (shopping behaviour) identified based on the outputs of identification questions. The data characteristics of the research parts are presented in Table 1.

Tab. 1 – Characteristics of research samples. Source: own research

Variable	Statistics properties	The first part of the research, January 2020, n = 773		The second part of the research, June 2020, n = 195	
		Count	%	Count	%
Gender	Man	373	48,3	82	41,6
	Woman	400	51,7	113	57,4
Generation	Baby Boomers	153	19,8	16	8,2
	Generation X	243	31,4	63	32,3
	Generation Y	357	46,2	113	57,9
	Generation Z	20	2,6	3	1,5
Household members	1 person	51	6,6	15	7,6
	2 persons	210	27,2	83	42,1
	3 persons	246	31,8	45	22,8
	4 persons	177	22,9	38	19,3
	More than 4 people	89	11,5	14	7,1
Size of residence (inhabitant)	Up to 1,000	113	14,6	7	3,6
	1,001 – 5,000	157	20,3	38	19,3
	5,001 – 20,000	127	16,4	34	17,3
	20,001 – 100,000	169	21,9	56	28,4
	More than 100,000	207	26,8	60	30,5
Income*	Up to 750 EUR	49	12,9	3	1,5
	750 – 1128 EUR	140	18,1	31	15,7
	1129 – 1503 EUR	178	23,0	38	19,3
	1504 – 1879 EUR	164	21,2	45	22,8
	1880 – 2255 EUR	81	10,5	16	8,1
	2256 – 2631 EUR	55	7,1	11	5,6
	2632 EUR	55	7,1	51	25,9
Online grocery shopping behaviour	Several times a month	153	19,8	61	31,3
	Several times a quarter	153	19,8	51	26,2
	Several times a year	170	22,0	31	15,9
	Less often	297	38,4	52	26,6

\* income was converted at the rate of 1 EUR = 26.7 CZK (exchange rate of the Czech National Bank – 1.7.2020)

For the sorting of responses by generations in the Czech Republic, Hole, Zhong and Schwartz (2018) generations theory were used as follows: In 2020 Generation Y includes people 20 – 39 years old; Generation X include people 40 – 54 years old; Baby Boomers include people more than 55 years old. All respondents are residents of the Czech Republic due to the identified place of residence (relevant region – not included in Tab.1 due to complexity), the age range of respondents is from 18 to 65 years (for research purposes transferred to individual generations

– Baby Boomers, Generation Y, Generation X, Generation Z) and the frequency of online grocery purchases ranges from less often to several times a month.

Both studies are similar in sample distribution. The most interesting difference in the samples is in the case of online grocery shopping behaviour, where the percentage of customers buying grocery online in the "several times a month" category increased and at the same time the percentage of customers buying grocery online in the "less often" category decreased. Considering this, it can be confirmed that the characteristics of the research sample correspond to the set of individuals purchasing grocery online in the Czech Republic (were defined as residents of the Czech Republic aged 18 and over who bought grocery online through the website).

## 4 RESULTS

Figure 1 indicates a change in the share of retailers in the Czech online grocery market caused by the pandemic from the number of customers served. In January 2020, the TOP 3 companies in this market served approximately 90% of all customers in this sector. These companies have held their privileged position on the Czech online grocery market since 2016.

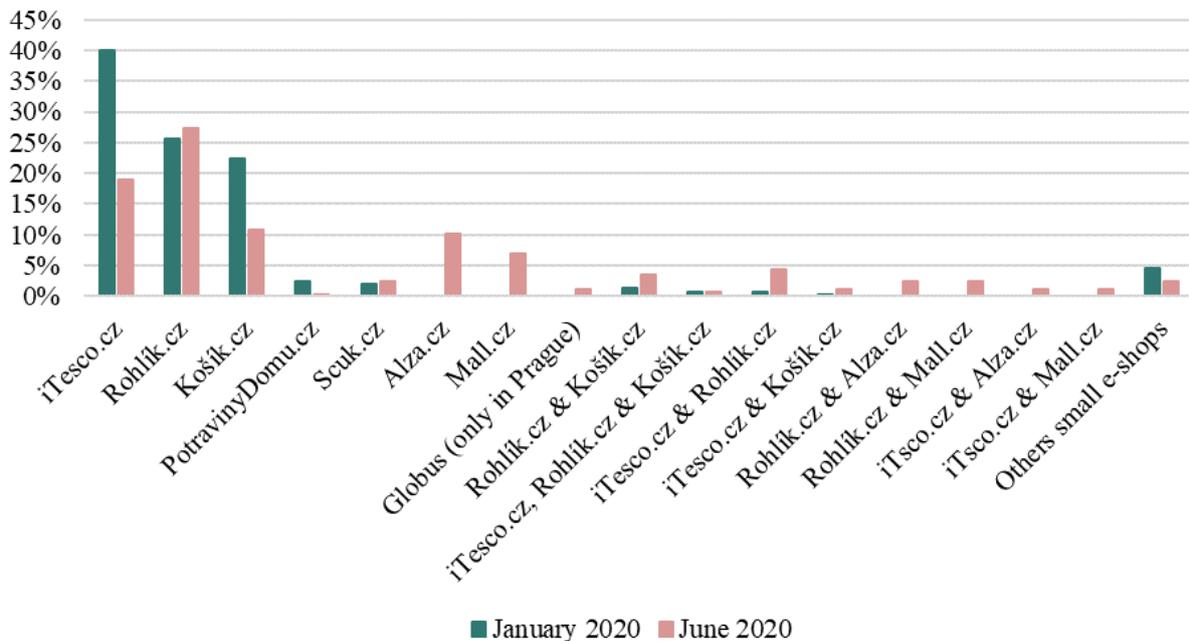


Fig. 1 – The share of customers. Source: own research

However, after the outbreak of the pandemic, we see a change that led to a reduction of TOP 1 customers served on the Czech market and relocation of customers to e-shops that responded promptly to the situation on the market and started offering grocery online (Alza.cz and Mall.cz). Another e-shop that reacted very quickly was Rohlík.cz, which strategically approached the development of the market. The number of serving customers of Rohlík.cz increased slightly, as the only one of TOP 3 e-shops on the Czech market.

Other identified e-shops (PotravinyDomu.cz, Scuk.cz and Globus) operate only locally, which corresponds to their amount of served customer share. There are also other small e-shops on the online grocery market in the Czech Republic, which, however, reached such low shares that they were merged into the “others small e-shops” group. This group includes these e-shops: MypurchaseOstrava.cz, Awashop.cz, Mixit.cz, Grizly.cz, Atoto.cz, countrylife.cz, prostraviaradost.cz and biokosiky.cz.

## The impact of the pandemic on customers' shopping behaviour

Research from June 2020 examined how the Covid-19 pandemic affected the behaviour of customers buying grocery online. According to the results of the research (Fig. 2), it can be stated that this pandemic had a great influence on the customers' behaviour in this sector, as every second respondent changed their shopping behaviour when buying grocery online in some way. Nevertheless, only 4.6% of customers started shopping for grocery over the internet much more often than they were used to. Thus, even in the context of online grocery shopping, less than 5% of customers resorted to so-called stockpiling trend.

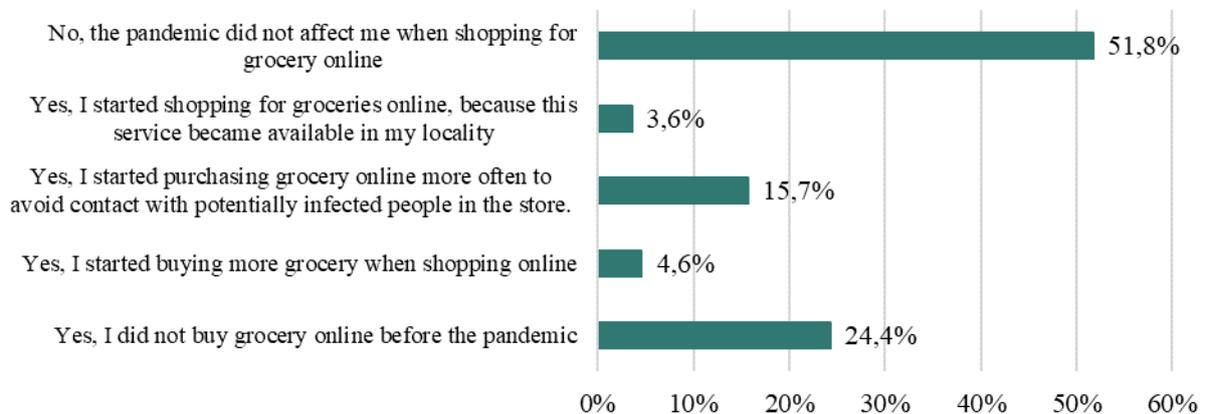


Fig. 2 – The impact of the pandemic on customers' shopping behaviour. Source: own research

The *first hypothesis* assumed that one of the positive consequences of the Covid-19 pandemic was the impulse leading to faster acceptance of online grocery purchases. This hypothesis is confirmed by the fact that 28% of respondents started buying grocery only after the outbreak of this pandemic, while the average year-on-year increase in customers buying grocery online in the Czech Republic (Eurostat, 2020) is 7.6% in the last 4 years. Moreover, the largest change in the number of shoppers was in 2018, when 13% more customers started buying grocery online.

Figure 3 shows a possible prediction (estimated based on the results of a questionnaire survey of this research added to the value of the previous year) of the individuals purchases grocery online for 2020.

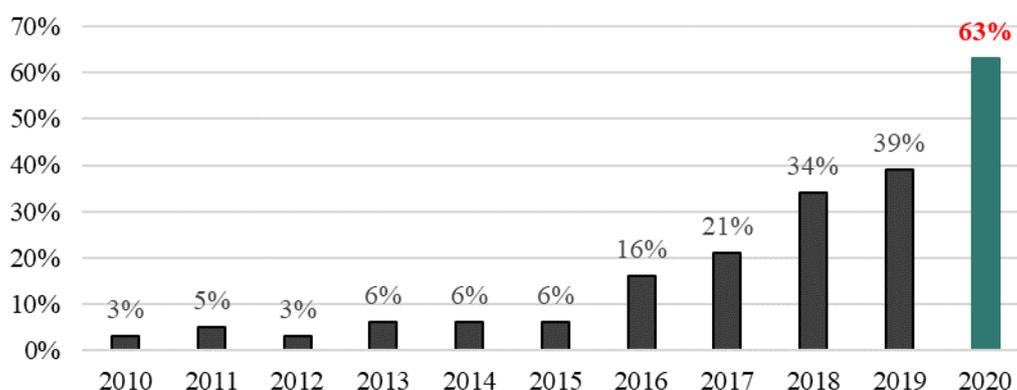


Fig. 3 – The prediction of OGS by individuals. Source: Eurostat (2020), own research

The *second hypothesis* assumed that consumers buying grocery online could, in connection with the effects of the Covid-19 pandemic, begin to perceive buying grocery online as a safer form of obtaining them. This hypothesis was confirmed, as almost 16% of respondents started buying grocery much more often online due to the pandemic. In this way, these respondents wanted to avoid potentially infected people in stores.

The results of the research also suggest that in connection with the pandemic, some companies began to serve new markets, as 3.6% of respondents started buying grocery online precisely because it was already possible in this context in their locality.

Overall, none of the customers who started shopping for grocery online after the outbreak of the Covid-19 pandemic (28% of respondents - those who answered “Yes, I started shopping for groceries online, because this service became available in my locality” or “Yes, I did not buy grocery online before the pandemic”) did not state that they would stop buying grocery after the pandemic mitigation. A total of 40% of these customers stated that they have only bought grocery once, but that they plan to continue shopping grocery in this way. The remaining 60% of these customers buy grocery online at a certain frequency, with most of them (24%) even buying grocery several times a month.

**Customer satisfaction analysis**

Due to the distribution of the research sample of respondents according to specific retailers (specified according to the names of their e-shops), where respondents buy grocery online, the following analyses will be performed only for the first three companies, occupying the largest share of respondents. This distribution (Fig. 1) corresponds to the secondary research, which found that the TOP 3 companies on the Czech online grocery market include those companies operating the e-shops iTesco.cz, Rohlík.cz and Košík.cz. The answers of the respondents, who stated that they buy from companies in the TOP3, but from several merchants at once, were also removed from the subsequent research to achieve relevance of evaluation.

The overall satisfaction of customers buying from retailers in the TOP 3 in the surveyed market is similar in all examined cases (Fig. 4) in the case of the survey conducted in January 2020. For clear results, the answers of respondents who could not assess the satisfaction were removed, because indeterminate answers are not relevant concerning the examined area. Very subtle nuances are observable only in the case of iTesco.cz when the ratio of satisfied and rather satisfied customers is not as balanced as in the case of Rohlík.cz and Košík.cz. The overall satisfaction in the case of iTesco.cz reaches the value of approximately 69%, while Rohlík.cz and Košík.cz are even better with an approximate overall satisfaction of 75%. The overall dissatisfaction with the purchase of grocery online from the surveyed retailers ranges from 7-8%.

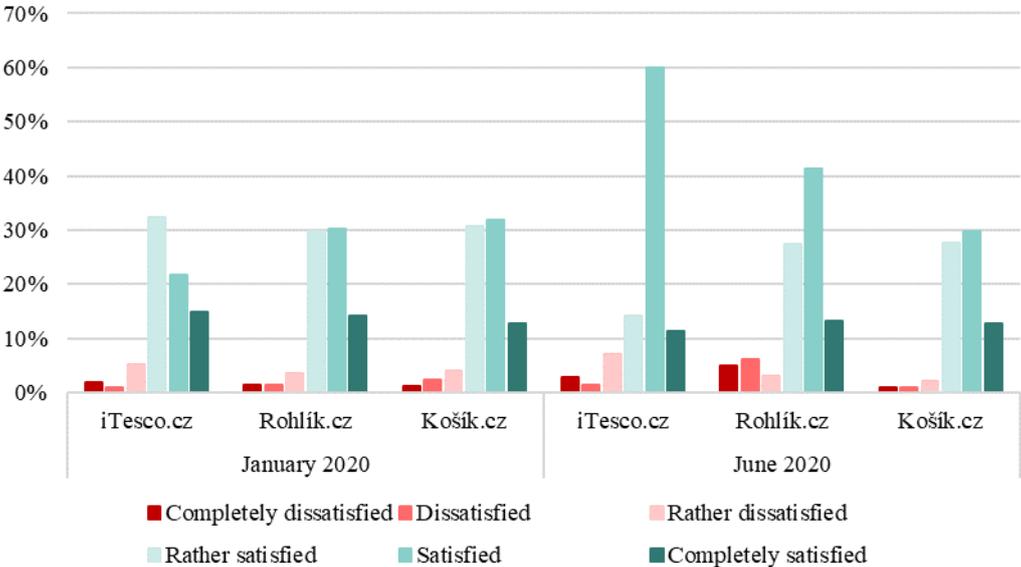


Fig. 4 – The level of overall satisfaction with e-shops. Source: own research

The research conducted in June 2020 showed a change compared to the previous survey, when the perception of satisfaction changed at iTesco.cz (86% of total satisfaction) and Rohlík.cz (82% of total satisfaction) towards a higher level of overall satisfaction. However, in the case of the Košík.cz, the overall satisfaction dropped slightly about 70%. Given these results, H3, which was formulated as: *"Satisfaction with TOP 3 online grocery retailers has increased as a result of the Covid-19 pandemic."* The third hypothesis cannot be confirmed, as the increase in overall satisfaction was demonstrated in only 2 of the 3 retailers in the TOP 3 in this market.

An important question is what causes customer dissatisfaction among the surveyed retailers and how it has changed in the event of a pandemic. Although overall satisfaction is high, effective relationship management with dissatisfied customers is also a very important tool for improving their services, which is very important given the strong competition between these retailers. To reveal the possible cause of dissatisfaction, a deeper examination of customer satisfaction with individual attributes of the service is performed (Table 2).

As in the previous analysis, the neutral answers of the respondents were excluded from this analysis as well. This analysis focused on grocery options offered, delivery options, delivery price, quality of grocery, prices of grocery, ease of purchase via the website, ease of purchase through the application, special discount offers and satisfaction with loyalty programs.

In each examined attribute, changes are highlighted (bold and dark grey colour) that show a better perception of the service (online grocery shopping) during the pandemic period (decrease in the value of not satisfied and increase in the value of satisfied) for clarity and simple comparison between the examined periods.

Tab. 2 – Satisfaction with the attributes of the service. Source: own research

SERVICE ATTRIBUTE	E-SHOP	January 2020		June 2020	
		Not S*	S**	Not S	S
Grocery options offered	iTesco.cz	16,7%	66,7%	<b>7,0%</b>	<b>88,6%</b>
	Rohlík.cz	7,7%	84,6%	8,9%	<b>91,2%</b>
	Košík.cz	16,67%	66,7%	<b>7,5%</b>	<b>84,6%</b>
Delivery options	iTesco.cz	9,1 %	63,6 %	<b>5,6%</b>	<b>90,2%</b>
	Rohlík.cz	0,0 %	89,7 %	2,5%	<b>97,5%</b>
	Košík.cz	12,5 %	62,5 %	<b>5,1%</b>	<b>79,4%</b>
Delivery price	iTesco.cz	11,1 %	66,7 %	22,5%	54,9%
	Rohlík.cz	10,7 %	71,4 %	<b>2,5%</b>	<b>97,5%</b>
	Košík.cz	33,3 %	50,0 %	<b>12,8%</b>	<b>51,2%</b>
Quality of grocery	iTesco.cz	10,0 %	80,0 %	12,7%	<b>83,2%</b>
	Rohlík.cz	10,7 %	82,1 %	<b>6,3%</b>	<b>84,9%</b>
	Košík.cz	11,1 %	66,7 %	12,8%	64,1%
Prices of grocery	iTesco.cz	4,6 %	90,9 %	14,1%	77,5%
	Rohlík.cz	15,4 %	65,4 %	<b>6,3%</b>	<b>84,8%</b>
	Košík.cz	28,6 %	42,9 %	<b>28,2%</b>	<b>56,4%</b>
Ease of purchase via the website	iTesco.cz	12,5 %	62,5 %	19,7%	<b>76,1%</b>
	Rohlík.cz	3,7 %	92,6 %	6,3%	87,3%
	Košík.cz	0,0 %	83,3 %	15,4%	69,1%
Ease of purchase through the application	iTesco.cz	4,4 %	87,0 %	9,9%	70,4%
	Rohlík.cz	11,5 %	80,8 %	<b>9,6%</b>	69,6%
	Košík.cz	28,6 %	57,1 %	<b>7,7%</b>	51,2%
Special discount offers	iTesco.cz	9,1 %	81,8 %	22,5%	62,0%
	Rohlík.cz	14,8 %	44,4 %	<b>12,7%</b>	<b>75,9%</b>
	Košík.cz	55,6 %	11,1 %	<b>7,7%</b>	<b>71,8%</b>
Satisfaction with loyalty programs	iTesco.cz	12,6 %	58,3 %	42,3%	42,2%
	Rohlík.cz	15,2 %	55,6 %	<b>12,7%</b>	<b>62,0%</b>
	Košík.cz	13,9 %	59,0 %	23,1%	33,3%

\*Not S – Not satisfied

\*\*S - Satisfied

The main attributes with which the customers of the iTesco.cz e-shop was most satisfied in January 2020 include the prices of the offered food and the offer of discount events. However, in comparison with the research in June 2020, satisfaction with these attributes decreased. In the case of the offered loyalty programs, satisfaction decreased during the period under review and, given the level of dissatisfaction, it would be appropriate to improve the current system of offered loyalty programs due to the growing share of competitors' customers. This attribute is very important from customer loyalty, so it can be a big problem that almost every second customer is dissatisfied with the offer of loyalty programs. Although in overall satisfaction iTesco.cz achieves the highest level of all surveyed retailers, it is important to focus on these individual attributes of satisfaction with the service, as in some iTesco.cz achieves the lowest satisfaction. The results show that customers are the least satisfied with the price for the delivery of the purchase, which may be related to the fact that at the onset of the pandemic, this e-shop cancelled sales promotion in the form of free purchase when reaching a certain purchase value. In this e-shop, satisfaction increased only for 4 attributes out of 9, while it decreased for the remaining 5.

The Rohlík.cz e-shop has achieved a very high level of overall satisfaction with its customers. During a detailed examination, it was found that it excels, for example, in the area of delivery options and the price of its delivery, the number of grocery variants, the quality of grocery and the simplicity of ordering via the website. Nevertheless, the first research revealed attributes with which customers are not very satisfied. The biggest problem was the dissatisfaction of customers with the offered loyalty programs and the offer of special discount promotions. However, Rohlík.cz was probably able to solve these problems even during the pandemic, because satisfaction has now increased in these areas. This e-shop has increased satisfaction with 7 of the 9 attributes of the service.

The last e-shop was evaluated more negatively in the June 2020 survey in connection with previous results from January 2020. When analysing specific attributes, it was revealed that Košík.cz is very well rated in 5 of 9 attributes. The biggest positive change was recorded in discount events, where only 11% of customers were originally satisfied, while in the June 2020 survey it was already an incredible 72% of customers. However, there was a very negative change in satisfaction with the offered loyalty programs. Initially, 59% of customers were satisfied with these programs, but in a later investigation, only 33% of customers stated that they were satisfied with the loyalty program.

## **5 DISCUSSION**

The aim of this paper was to explore how the pandemic influences the customer perception of their satisfaction with online grocery shopping and how it changes their behaviour due to online grocery purchasing. According to Roggeveen and Sethuraman (2020), academic research must strive to understand the short-term and long-term impact of the pandemic on consumer behaviour and provide guidance on how retailers should cope with changes which pandemic of Covid-19 brings. The results of this research suggest that changes in consumer behaviour associated with acceptance of online grocery purchases may have a long-term impact. All respondents who started buying grocery online after the outbreak of the Covid-19 pandemic did not say that they would stop buying grocery in this way even if the pandemic mitigated. Now, 60% of these customers buy grocery repeatedly and 40% of these respondents said that even if they bought only once, they plan to buy like this even after the pandemic mitigation.

Roggeveen and Sethuraman (2020) state that new behaviours adopted by retailers and consumers during the pandemic may become the new-normal, based on the results of research it is evident that for consumers the new-normal will become online grocery shopping because

28% of respondents said that they did not buy grocery online before the pandemic and that they want to continue buying grocery in this way even after the pandemic mitigation. The findings of this paper confirm that market concentration continues in the online grocery market and show that there has indeed been a shift to online grocery shopping in the wake of the Covid-19 pandemic, as claimed by Richards and Rickard (2020).

The identified changes in customer satisfaction with individual attributes were not only affected by the pandemic itself, which affected the psyche of customers, but also by the reaction of e-shops. Some of them stopped offering sales promotion (iTesco.cz), others changed the loyalty program (Košík.cz - new loyalty program). The effect of customers' perception of the level of individual attributes was thus influenced by subjective and objective factors. It can be said that the market development strategy (delivery in new locations) and product development strategy (3 new services - Buy Safely, Suchý Rohlík, Rohlík Bistro) of e-shop Rohlík.cz was a very good step in this situation. Mainly due to the increase in overall satisfaction, increased satisfaction with individual attributes of the service and an increase in the number of customers in the period after the outbreak of the pandemic. This company thus managed to react not only very quickly to the situation, but also by taking appropriate steps that strengthened and even improved its position in the market. This shows that the knowledge from the Ansoff's' matrix can be used not only in the normal management of the company's growth but also in the emergence of unexpected situational factors (black swan) when it is necessary to react more quickly than usual.

### **Implications for practice**

The online grocery market in the Czechia is specific due to the predominant number of purely e-retail retailers operating in it. Among the most well-known, occupying the largest share of customers on the market are e-shops Rohlík.cz, serving approximately 27% of customers in this market, Košík.cz (approximately 10% of customers), Alza.cz (approximately 10% of customers) and Mall.cz (approximately 7% of customers). Tesco Stores ČR, a.s., which operates the iTesco.cz e-shop, is currently the largest hybrid company on the Czech online grocery market, occupying the largest percentage of customers in this market at the beginning of 2020. In total, these e-shops serve approximately 90% of customers in this online category. The e-shops iTesco.cz, Rohlík.cz and Košík.cz can be ranked in the TOP 3 of this sector. According to the research agency InsightLab, in 2018, the iTesco.cz accounted for a total of 41% of all customers in this market, Rohlík.cz 21% and Košík.cz 16%. The results of the research show that this distribution is similar at the beginning of 2020 when 40% of respondents belong to iTesco.cz, 26% of respondents to Rohlík.cz and 22% of respondents to Košík.cz. Compared to the June 2020 research, it can be stated that iTesco.cz has started to lose its dominant position in this market, while the growth trend in the case of Rohlík.cz is continuing.

In the subsequent analysis of the overall satisfaction of e-shops in the TOP 3, it was found that in the period after the outbreak of the pandemic, iTesco.cz (86%) and Rohlík.cz (82%) reach the highest level of customer satisfaction, while in the case of Košík.cz this rate slightly lower (70%). A deeper examination of the satisfaction of selected attributes of online grocery purchases in the period after the outbreak of the pandemic revealed significant differences in the achieved level of customer satisfaction. Satisfaction with the offered number of grocery variants was probably most affected by the pandemic period, which may be a consequence of the sale of certain assortment categories in stores. Another significant effect can be seen in the large increase in satisfaction with the possibilities of delivery when in all examined e-shops this satisfaction increased significantly. The biggest positive change in the perception of satisfaction occurred in the Rohlík.cz when it increased in a total of 7 out of 9 examined attributes. This is probably a consequence of the proactivity of this e-shop during the pandemic and the rapid

change of strategy (market development and product development) caused positive adaptation to the new market environment. Other researched e-shops were not so proactive, which was reflected in the perception of satisfaction with the researched attributes. Based on the research results, it was observed that the attributes (quantity of grocery variants, purchase delivery options, purchase delivery price, quality of grocery and their prices), which could be supported by changes related to the onset of the Covid-19 pandemic, were significantly more positive evaluated after the outbreak of the pandemic than before its onset. These findings may be related to the fact that Bialkova, Grunert and van Trijp (2020) found that time pressure affected customer behaviour and product choice, and this effect was probably also evident in online grocery shopping.

### **Limitations and future research**

The limit of the research may be obtaining a small sample of respondents in the second questionnaire survey (June 2020) compared to the first questionnaire survey (January 2020). This difference is because the first survey was conducted with the help of a research agency for a fee, where the respondents were financially motivated to answer the questionnaires. The second questionnaire survey was conducted by self-collection through online discussions and forums focused on online food shopping and food shopping in connection with the consequences of the COVID-19 pandemic and addressing combined students via the university's e-mail address book. This step was taken as there was a concern that the research agency's online panel would not yet include those respondents who started buying grocery online after the pandemic. Given that these respondents were not offered any financial reward, they did not have to be so motivated and therefore the sample of the second survey was not as high as the first. Future research should focus on how this situational factor (Covid-19) has affected customers in the longer term and whether the negatives associated with grocery stockpiling, which significantly disrupts the flow of distribution chains, can be prevented.

## **6 CONCLUSION**

The dynamic moving of grocery customers to the online environment is one of the huge changes, which can cause a long-term impact on online grocery shopping. The Covid-19 pandemic has had a major impact on the change in consumer behaviour in the sector, as every second respondent has changed their shopping behaviour. Overall, 28% of customers purchasing grocery online have accepted this way of shopping in direct connection with this pandemic. Customers have begun to prefer to buy grocery online to avoid contact with potentially infected people in the store. This was a total of 16% of the surveyed respondents. The stockpiling phenomenon also occurred in this area, with a total of 5% of respondents saying that they started buying much more grocery when shopping online than before the pandemic.

Following the outbreak of the pandemic, the structure and number of e-shops offering grocery online on the Czech market also changed. New players have entered the market, the most influential of which are Alza.cz and Mall.cz, who have an advantage in the established brand within other online product categories. Of the TOP 3 companies, only Rohlík.cz adapted very well to the situation associated with the pandemic and even strategically approached the development of the market and product, which according to the change in served customers was a very good step that contributed to the company's stability in the market.

The already dynamic development of online grocery shopping in recent years, which has now been supported by the current pandemic, has a significant impact on the distribution of online and offline retail sales. Based on the results of the research, it can be estimated that the percentage of customers purchasing grocery online can increase up to 63% in the Czechia this

year, while this value (specifically 62%) was estimated in the optimistic variant for 2021 (Bauerová, 2019). The acceptance of online grocery shopping was accelerated. These structural changes suggest that the next stage of development, which we can call digitalization, in grocery retail has already taken place due to the need to electronization processes to ensure competitiveness in the grocery market. In the online grocery market, market consolidation is likely to take place in the coming days due to strong market concentration and emerging very small e-tail competitors. This is also reflected in the results of this study, which show that consumer behaviour has changed as a result of the pandemic in favour of online grocery shopping, which they perceive as a safer form compared to traditional stores, where a large number of customers congregate. Nowadays, it is possible to observe the mitigation of the negative factor - the impossibility of physical inspection of grocery when buying in the online environment with the benefit that the online environment brings, which is safer purchasing from the perspective of customer health (possibility of avoiding Covid-19).

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# PROCEDURE MODEL FOR THE DEVELOPMENT OF DIGITAL STRATEGIES

*Stephan Bauriedel*

## **Abstract**

Digitisation is certainly an issue with relevance for the future. The challenge in developing a digital strategy appears to be to launch the first steps and ensure the success of the project. The process model – Digital Action – was designed to define holistic strategies for digital transformation in established companies. The result is a process method analogue to a pyramid, which depicts the strategic, organizational, and technological aspects of transformation. Extensive research has shown that a lot has already been written about digitisation, but there is no clear definition of what constitutes a digital strategy. In the publications the effects of digitisation are pointed out, business models as well as technologies are explained and entrepreneurs are called to act. However, there is a lack of specific instructions for action. The components of a digital strategy were determined in various iteration stages and transferred to the model. For this purpose, the existing knowledge fragments were further developed, the characteristics of electronic platforms examined, established process models screened, and the author's expertise was considered. It was shown that business model design plays a central role in the development of digital strategies. However, before a rethink can take place, a strong trigger is needed. Furthermore, it became clear that it is essential to realign the IT infrastructure. Finally, the model was examined from different perspectives and a practice-oriented simulation was carried out.

*Keywords: process model, digital strategies, digitisation, digital transformation*

## **1 INTRODUCTION**

Digitisation is an opportunity as much as a threat for every company. The challenge is the digital transformation, the shift from an analogue organisation to a platform-oriented business model. To be able to control the complexity of the project, entrepreneurs demand an orderly approach. Schwab, the founder, and chairman of the World Economic Forum in Davos describes digitisation as the fourth industrial revolution (Schwab, 2016). He sees a far-reaching change in human civilisation with a multifaceted interaction between technology and society. Glaser (Glaser, [n. d.]), author and honorary member of the Chaos Computer Club, has marked the upcoming development in a formative statement: "Everything that can be digitised will be digitised. Everything." He predicts that the digital revolution will advance far more radically and rapidly than the industrial revolution.

Digitisation fundamentally changes existing business models. It shifts, merges and formats markets. New market participants are emerging, and established competitors are disappearing. Digitisation can represent a substantial development or be completely disruptive. The challenge in developing a digital strategy is to make the opportunities and threats visible. It is necessary to describe a path into an uncertain future, to initiate the first steps – especially when the old factors of success no longer exist.

## 2 THEORETICAL BACKGROUND

The comprehensive literature research shows that there is a high quantity of publications whose qualitative contribution is rather small. There is a fundamental lack of definition of the terms, the evaluation of the benefit, the investment, the risk as well as a procedural model. In particular, the literature shows that many experts adapt this topic without providing any insights. They emphasise that digitisation will change everything, that companies must prepare themselves and that a digital strategy is needed. The business models of well-known internet giants such as Airbnb, Uber and booking.com are also gladly explained. But in the end, they only describe how a platform, or innovative technologies that make up the digitisation, work. There is little theoretical background on how traditional companies can transform and digitalise their processes.

### Strategy development

Strategy development is an already well-researched field. Macharzina and Wolf (2018) derive two basic understandings of the term strategy. On the one hand, a strategy is defined as a rationally planned bundle of measures or a basic pattern in the stream of entrepreneurial decisions and actions. For strategy development, various analytical methods are used to develop rational measures that support the strategic orientation. However, it has become apparent that the traditional instruments of environmental and corporate analysis, SWOT analysis or value chain (Porter, 2008) are not suitable for the development of digital strategies. They provide answers for an analogue world and cannot capture the essence of digitisation.

The development of a digital strategy requires new thinking as the success factors are changing. Digital strategies aim to drastically reduce costs by eliminating operational work, achieve an almost infinite output and increase customer value. The sum of these three benefits (Fig.1) represents a competitive advantage that a traditional company with its analogy way of working can never realise. It takes courage and decision-making power to let go of established patterns.

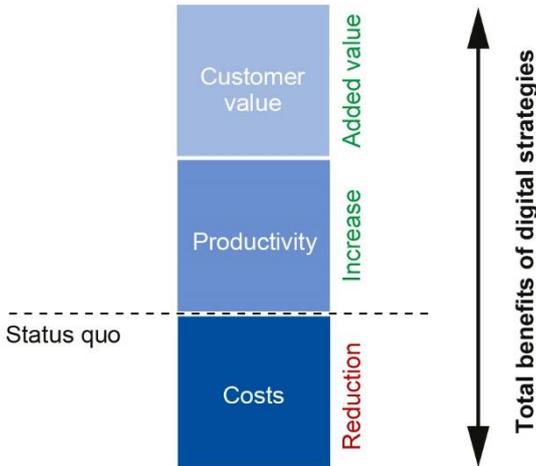


Fig. 1 – Total benefits of digital strategies. Source: own research

The derivation of the total benefit is a synthesis of various knowledge fragments. Rifkin (1995) described early on in his book "The End of Work" a thought that aptly characterises digitisation: Algorithms replace employees. He later supplemented his work with the book "The Zero Marginal Cost Society" (Rifkin, 2014), which describes the decline in prices based on the lowest marginal costs. The micro economist Clement shows how transaction costs for digital goods are falling and are falling even further due to the network effect (Clement et al., 2019).

Anderson, Schöbitz and Vode (2009) go one step further and describes how companies can earn money with "free" products and services.

Manyika and Chui (2014) compared the productivity of the top three car manufacturers in 1990 with that of the top three internet giants in 2014. Today, the internet giants achieve a similar turnover with a fraction of employees. Their productivity has increased enormously. Ismail, Malone and van Geest (2017) have studied "exponential organisations" and explains how the new hyper scalers increase their output exponentially via externalities. According to his definition, exponential organisations (ExO) are "organisations whose impact (or return) is disproportionately high - at least ten times higher - than that of comparable organisations. As externalities it calls staff on demand, communities and assets that are used without owning them.

A study of digital business models shows that they have a higher value for the customer, because digital business models work anytime, anywhere and are particularly simple. (Bauriedel, 2017)

### **Business Model Design**

Schallmo and Williams (2018) name the digital transformation of business models as a key element for the development of digital strategies. The business model describes the basic logic of a company or organisation and has to be adapted to the potential of digital technologies. For this purpose, Schallmo and Williams (2018) and other authors repeatedly cite the Blue Ocean Strategy as well as Osterwalder's Canvas Model.

The Blue Ocean Strategy (Kim & Mauborgne, 2015) is interesting for the development of new business models because it calls for ignoring existing competition, thinking outside the box and opening new markets. The new business idea should offer greater benefits to the customer while reducing costs. Both reflect the benefits of digitisation.

With his book "Business Model Generation", Osterwalder and Pigneur (2011) presented the Canvas model with nine segments, which is perfectly suited for designing new business models. While the left side of the canvas is focused on the customer, the right side is oriented towards the business model. The development of the canvas poster is a creative and group-dynamic process.

With Value Proposition Design, Osterwalder et al. (2015) have added an important facet to their theory of the business model Canvas. Both focus on two important fields of the business model: the value proposition and the customer segment. The method combines the value proposition of the company with the appropriate target group.

The digital business model is a new and important instrument for the development of digital strategies, as it exploits the opportunities offered by the new technologies.

### **Knowledge of methods**

In practice, two diametrical approaches can be seen. Strategy consultants (Rusnjak & Schallmo, 2018), start with the idea and develop an innovative business model. They neglect the culture, the organisation, and the existing IT infrastructure. System providers, on the other hand, place technology first. They present the systemic excerpt which they master and ignore both the strategic and business implications. Both approaches have conceptual gaps that can lead to the failure of digital transformation.

In the literature, agile methods for software development, such as SCRUM are referred to (Schwaber & Beedle, 2004). Schwaber is a pioneer in this field and has presented a simple, fast and change-oriented method. The disadvantage of his method is the poor planning of the

project, which starts with user stories. But the implementation of individual functional blocks using an agile method can only be advantageous when the strategic, organisational and technological levels have been defined. In the area of planning, a solid analysis and conception according to the methods of classical project management (plan-build-run) provides the necessary security.

A business case (Brugger, 2009) should be formulated to describe the project. The business case is the more modern form of investment calculation for complex IT projects. The cost-benefit comparison is used for decision making and investment planning. Digitisation is not about pushing the use of technology, but about realising a business benefit through technology. The application of the business case evaluates this benefit and secures the decision.

### **Expertise of the author**

The author has over 30 years of experience in strategy, business, technology and change. As a management consultant, he has gained in-depth knowledge of the organisational structure of companies and their IT infrastructure in numerous projects. He has been researching and publishing on digital strategies and their implementation for five years (Bauriedel, 2017).

## **3 METHODOLOGY**

The outline of the theoretical background shows that there is little substance to develop digital strategies. It does not become clear which aspects have to be considered when developing a digital strategy compared to a traditional one. Digital business models represent an innovation with IT systems as a basis.

For the development of the process model shown later it was necessary to proceed in several steps to fill the existing knowledge gaps with insights. The first iteration stage described characteristics that distinguish digital platform models from analogue organisations. The platform runs like a machine and therefore offers major advantages. The following attributes describe the common character of platforms: direct, accessible, precise, transparent, dynamic, tireless and individual.

The second iteration stage examined the generic, business benefits of a digital strategy. Digitisation follows the three benefits (Fig. 1): low transaction costs, high productivity and more customer value. These three benefits are important for further consideration as they shed light on the economic aspects of digitisation. This led to the concise statement: Algorithms replace employees.

From that statement the mission for digital transformation is derived: operative work is systematically replaced by an IT platform. The business model, the organisation and the entire IT architecture must be realigned. Information is made usable, business applications (ERP, CRM, DMS) are exchanged or extended, and the networking of systems is essential for a continuous process flow. New, supporting processes (development, maintenance and operation) are created around the platform.

Finally, the method was tested in a theoretical simulation. With the expertise of the author the spare parts sales department (Fig. 2) of an industrial company was exemplarily replaced by a digital platform (Fig. 3) and connected to the existing structures of the company. The sample company corresponded to an industrial company he knew. The existing analogue and the aspired platform-oriented business model were visualized from the customer's point of view. A process model was created, which further specified the canvas model. The process model in turn forms the basis for the IT architecture (data, systems and interfaces). It turned out that the

business model is quite adaptable for a company with similar services, but that the processes and the IT infrastructure are extremely individual.

The simulation has shown that the process model includes all important functional blocks, presents them in a logical planning sequence and is redundant in itself.

Service  
Complaint processing

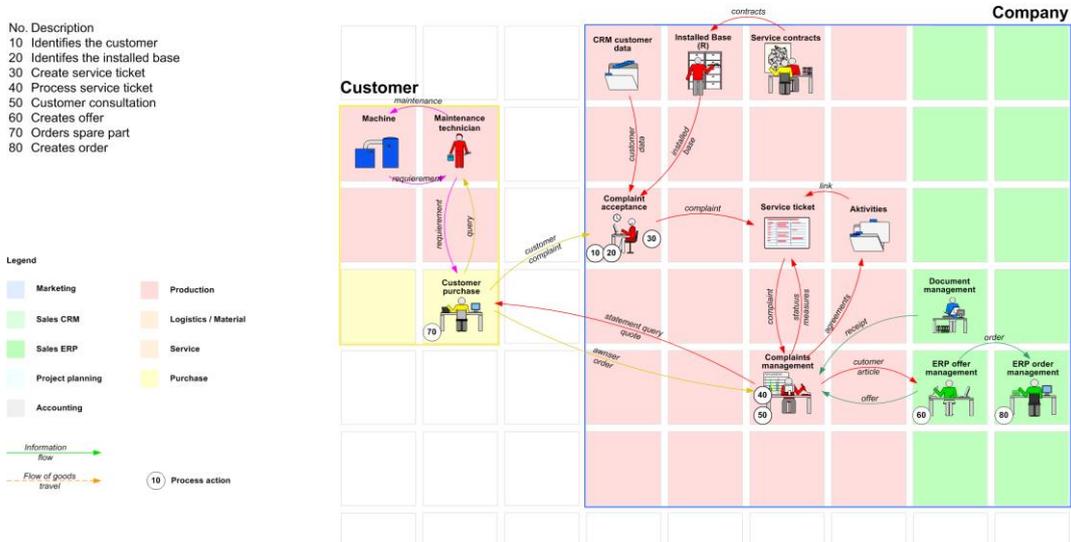


Fig. 2 – Process Modell of a Spare Part Sales. Source: own research

Service  
Spare part platform

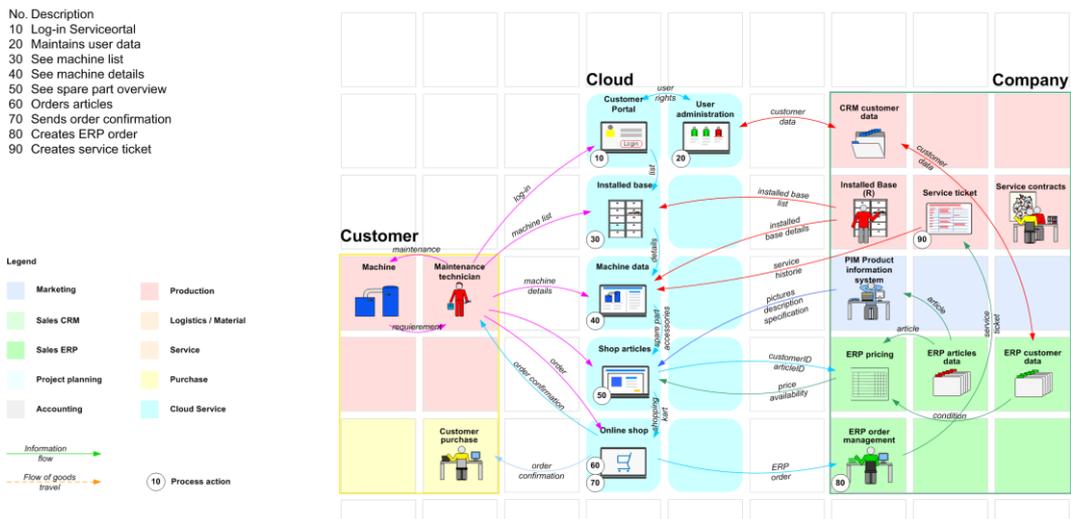


Fig. 3 – Process Modell of a Spare Part Platform. Source: own research

## 4 RESULTS

The findings led to the process model "Digital Action" (Fig. 4). It considers the strategic, organisational, and technological orientation of the company. The model works in two directions: The digital strategy is developed top-down, while the bottom-up approach is preferred for implementation. It is necessary to consider all five levels to identify the scale and quantify the effort required.

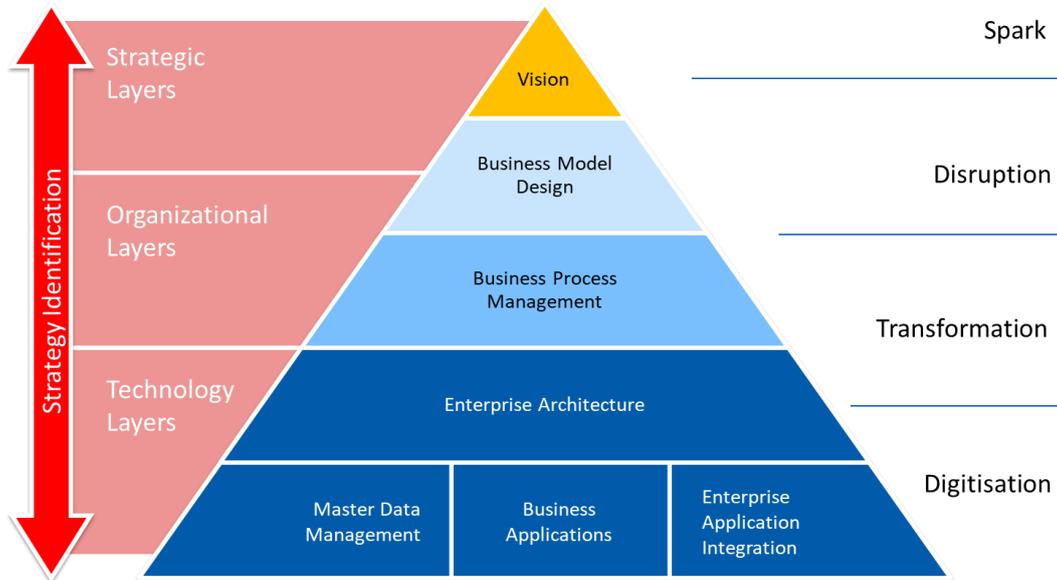


Fig. 4 – Digital Action Method. Source: own research

The pyramid is based on the procedure for the implementation of information technology used for business purposes: strategy, processes and systems. To meet the specifics of digitisation, two additional levels have been added: The Business Model Design and the Enterprise Architecture. The business model becomes mandatory because the general business idea has to be adapted to the new opportunities of changing business rules and modern technology. At the technological level, the model focuses on the entire IT infrastructure and divides it into three downstream clusters: Master Data Management, Business Applications and Enterprise Application Integration.

The labelling on the right side of the pyramid assigns the procedure to the terms of digitisation to show where happens what. The spark marks the initial trigger. Disruption begins with the vision and manifests itself in the digital business model. The transformation encompasses the organisation, the processes and the systems. Digitisation includes the storage, processing and exchange of information.

The process is visualised as a pyramid to visualise that the adaptation of the organisation requires greater effort and the realignment of the IT infrastructure usually represents the greatest expense. The implementation effort increases with the level of detail.

## 5 DISCUSSION

Digitisation is a difficult topic to discuss. In my role as a consultant, I talk to entrepreneurs, department heads, system providers and agencies. It's amazing how few people have a realistic idea about digitisation. One of my favourite topics is the law of digitisation: algorithms replace employees. It is unthinkable to those I talk to.

Let's try a simple use case: business travellers often rent a rental car on the way from the airport to the customer. In the stationary car rental company, there are employees who offer them the car, hand it over and settle the bill. This business model is analogous. However, those who rent an e-scooter on the street do everything via their app: register, rent and pay. The business model around the e-scooter is digital, because it follows the law of digitisation: algorithms replace employees. The stationary car rental company remains analogue, even if it offers an online check-in, because digitisation means that all employees are eliminated from the operative processes. The three benefit arguments low transaction costs, high output and more customer value can only be achieved this way.

The process model – Digital- Action – introduces a new layer, the Business Model Design. At this stage, new thinking is required and forms the intellectual core of the digital strategy. The digital strategy describes how an analogue company (employees) is transformed into a digital business model (platform). This requires a reorientation of the company (strategy, processes and systems).

This logical chain of arguments is not or only partly referred to in the literature, among consultants or technology providers.

## 6 CONCLUSION

The result shows that the development of digital strategies is a complex and interdisciplinary task. It starts with a picture of the future, the vision. From there on, viable business models are developed and tested. Within the organisation, traditional processes are developed further into digital end-to-end processes. The technological foundation is a modern IT infrastructure based on data, applications and their integration. Implementation requires conceptual experience and active change management. The description of the digitisation project as a business case is helpful, as it documents the order of a project and serves as a basis for decision-making.

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# SPECIFICS OF LOGISTICS PROJECTS IN THE PROCESS OF RISK MANAGEMENT

*Tereza Belantova, Pavel Taraba, Katerina Vichova*

## **Abstract**

The research aimed to determine what approach the Czech Republic enterprises have to the risk management process in logistics projects. The article briefly introduced the theoretical background with an emphasis on risk management and logistics projects. Then the real data were analysed. Data were collected in 2019. Despite more respondents, the conclusions were confirmed, and the most significant enterprises in the Czech Republic implement the risk management process through their employees and do not use external staff. The smaller majority of these enterprises have one person and may not have more risk management staff. An equally essential part of the research was to find out what methods of risk management are used in companies in the Czech Republic. The references of the authors refer to the point of this topic. For risk reduction, it is necessary to implemented risk management in enterprises. The aim of the article is to find out what approach the companies in the Czech Republic have to the risk management process in logistics projects.

*Keywords: logistics, logistics projects, risk, risk management*

## **1 INTRODUCTION**

One of the first definitions of risk is Bernoulli, who, in 1738, proposed measuring risk with the geometric mean and minimizing risk by spreading it across a set of independent events (Bernoulli, 1954). Risk can be seen as the possibility of economic or financial losses or gains due to the uncertainty associated with pursuing a course of action (Chapman & Cooper, 1983). Furthermore, Belás specify several types of risks as production, economic, market, financial, credit, legislative, political, environmental, personnel, information risks, and force majeure (Belás et al., 2015).

Risks are associated with every area of business, and the logistics area is no exception. The Czech Republic has a unique position in logistics within the Visegrad countries (Czech Republic, Slovakia, Poland, and Hungary). The Czech Republic has a unique geographical location, excellent transport infrastructure, and large logistics companies attracted mainly by relatively low wages and qualified employees. In companies doing business in the Czech Republic, the emphasis is placed on project management methods (Taraba, 2019), which positively impacts the management of logistics projects.

The aim of the article is to find out what approach the companies in the Czech Republic have to the risk management process in logistics projects.

## **2 THEORETICAL BACKGROUND**

Based on the body of knowledge in logistics projects, it was found that mainly Polish authors define them, i.e. Kisperska-Moroń & Krzyżaniak, (2009); (Pisz, 2009). Kisperska-Moroń & Krzyżaniak (2009) define a logistics project as a planned set of interconnected tasks to be carried out over a fixed period, with a limited budget and time to increase efficiency effectiveness of material flows and related information in companies, supply chains, or spatial systems. Pisz (2009) defines a logistics project as a complex, special and unique set of activities

that can be described by technical and economic parameters determined by cost, time, and scope to assist logistics management in the corporate / supply chain that they combine the main principles of project management (especially the emphasis on the three imperatives of the project - scope, time, and cost) with the logistics goals in companies or supply chains. A large number of foreign authors, i.e. Thun & Hoenig (2011); Johnson (2001); Blos, Watanabe, Quaddus, & Wee, (2009); Diabat, Govindan, & Panicker (2012) explore the risks of supply chain projects across different industries. In this article, the authors focus on logistics projects from the perspective of risk management in the Czech conditions. Belantová, Gálová, & Taraba (2019), who deal with the Czech Republic issue, define the logistics project as a set of activities that are limited in costs, time, and scope. Its purpose is to help logistics management in the company or supply chain prevent problems of the flow of people and expenses.

Risk management in companies has been introduced to mitigate and minimize risks. Gao indicated that formal risk management frameworks are designed for large enterprises and that the frameworks are too complicated and pricy for SMEs to adopt (Gao, Sung, & Zhang, 2013). Effective risk management may lead the project manager to several benefits, such as identifying the favourable alternative course of action, increased confidence in achieving project objective, improved chances of success, reduced surprises, more precise estimates, reduced duplication of effort, etc. (Bannerman, 2008). Belás et al. (2014) state that the most critical business risk is market risk, followed by financial and, eventually, personal risk. Financial risk management is an important area of SMEs (Belás et al., 2015).

In the whole world, we classify several sizes of enterprises. It could be classified as micro, small, medium-sized, and large enterprises. The article authors differentiate four categories – micro, small and medium enterprises (SMEs) and large enterprises. SMEs are inevitable parts of the market and knowledge economy (Karpak & Topçu, 2010); (Golej, 2016). Over 98% percent of all USA and the EU companies are SMEs (Bhaird, 2010). SMEs operate in a more challenging economic environment, respectively, many of them struggle with their survival (Belás et al., 2014). SMEs often lack resources to look at new avenues outside of their core competencies (Mittal et al., 2018). The use of project management methods in logistics management (especially in SMEs) is associated with the emergence of new unidentified and untreated risks. Larger companies have experts or even entire departments of experts to analyse potential risks. In comparison, for smaller companies and small businesses, the risk management process of logistics projects is challenging to understand.

### **3 METHODOLOGY**

The survey focused on companies dealing with logistics projects in the Czech Republic. The questionnaire survey was conducted with representatives of companies and workers dealing with logistics issues. The survey aimed to determine what approach companies have to the risk management process of logistics projects in the Czech Republic. The questionnaire was sent electronically by e-mail.

The questionnaire consisted of three main parts. The first part was focused on the employee himself, who was asked about the job position and the time he works in the company. The second part was aimed at the company. It was monitored whether the company was a micro-enterprise, a small enterprise, a medium-sized enterprise, or a large enterprise, based on its number. Furthermore, according to the businesses' scope, companies were categorized as a regional enterprise, a national enterprise, or a multinational company. The sectors were classified by the Ministry of Finance of the Czech Republic (2013). The third part of the questionnaire was focused on the companies' risk management process. It was examined whether only one employee carries out the risk management process or a separate department.

Finally, it was found out whether their employees realized the risk management process or whether they hire external staff and deal with this activity through outsourcing.

## 4 RESULTS AND DISCUSSION

A questionnaire survey was conducted for the purposes of this article. The survey was conducted in the companies do business in the Czech Republic. 24.4% of regional enterprises, 47.6% of national enterprises, and 28% of multinational enterprises participated in the research. Furthermore, the companies were broken down by size. The size of the company was determined by the number of employees working in the company.

The following table summarizes the data about respondents. As mentioned above, 82 respondents participated in the research.

Tab. 1 – Summarizing data about respondents. Source: own research

<b>Company size</b>	
Micro enterprise	1.2%
Small enterprises	34.1%
Medium-sized enterprise	39%
Large enterprise	25.6%
<b>Scope of company</b>	
Regional	24.4%
National	47.6%
Multinational	28%
<b>Sector of business</b>	
Manufacturing industry	6.1%
Wholesale, retail, repair and maintenance of motor vehicles	13.4%
Transport and storage	69.5%
Accommodation, catering, and hospitality	3.7%
Information and communication activities	1.2%
Undifferentiated goods- and services-producing activities of private households for own use	1.2%
Other activities	4.9%

The table above summarizes data on respondents involved in the research.

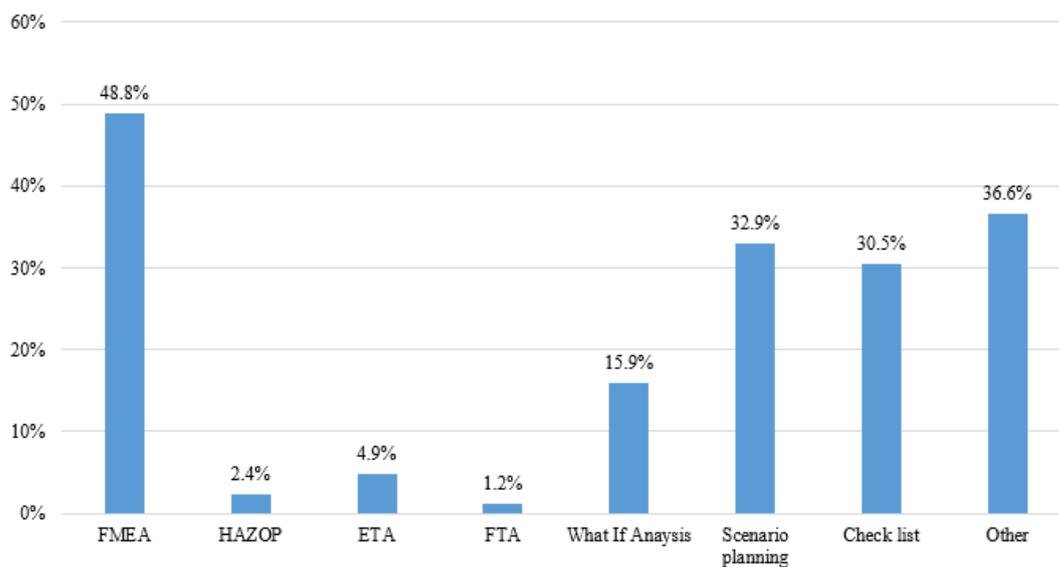


Fig. 1 – Methods found out in the research. Source: own research

Another question asked in the questionnaire was whether the risks are managed by an individual or whether companies have a multi-employee department for the risk management process. The

picture shows that in most Czech companies the risk management process is performed by a single employee.

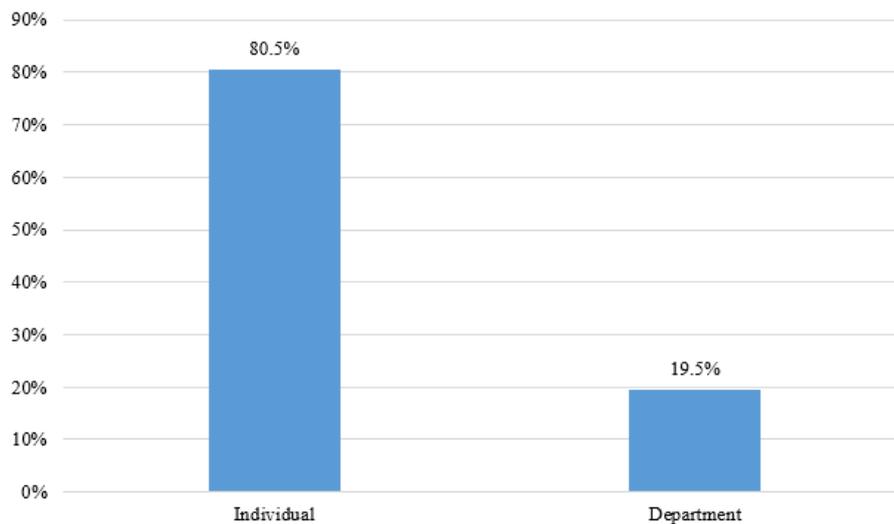


Fig. 2 – Ensuring the risk management process. Source: own research

The last question in the questionnaire survey was whether companies carry out the risk management process by their own employees or whether they hire external staff and deal with this activity through outsourcing. The picture clearly shows that the risk management process in Czech companies is in most cases carried out by company employees. The risk management process is carried out by employees at 91.5% of companies and only 8.5% of companies use external staff.

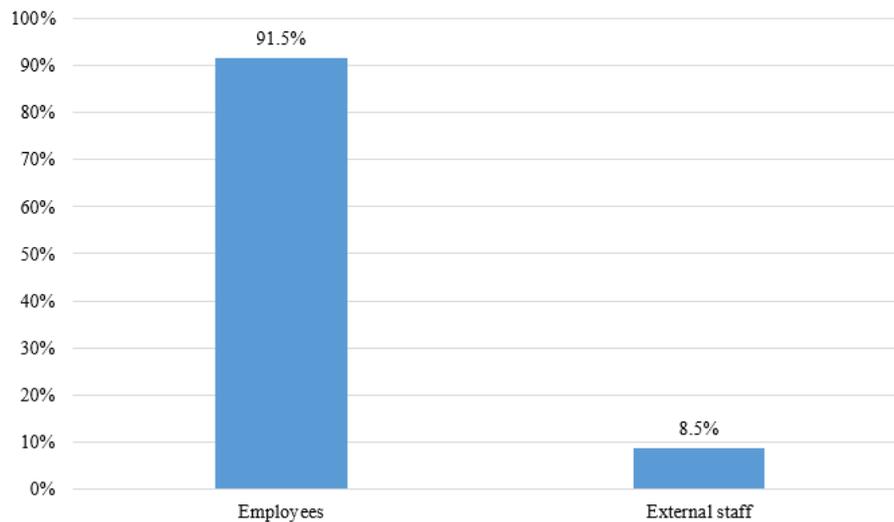


Fig. 4 – Implementation of risk management process. Source: own research

## 5 DISCUSSION

The aim of the article was to find out what approach the companies in the Czech Republic have to the risk management process in logistics projects. The sectors were classified by SCEA (Ministerstvo financí České Republiky, 2013).

In the paper were discuss the methods of risk management used by businesses in the Czech Republic. The following methods were found in research with fewer respondents: FMEA,

HAZOP, ETA, FTA, Scenario planning, Checklist, and What-If Analysis. The largest proportion of these methods is FMEA, which is used by nearly half of the respondents. Other methods that have been found have less representation in Czech companies.

The next was to solve the risks from the point of view are individual or whether companies have a multi-employee department for the risk management process. The risk management process in Czech companies is, in most cases, carried out by company employees. In most Czech companies, the authors found out that the risk management process is performed by a single employee rather than a multi-employee department.

## 6 CONCLUSION

The research underlying this article was carried out to find out information about the risk management process in companies operating in the Czech Republic. The purpose was to determine how companies in the Czech Republic approach the risk management process, whether their employees carry out this process or whether they hire external workers for this activity. Another essential point of the research was to find out whether the companies surveyed need only one employee for the entire risk management process or have a department with more employees. They are involved in the risk management process at the same time. An equally important part of the research was to find out what methods of risk management are used in companies in the Czech Republic. The paper is constructed in two parts. The first part of the article deals with theoretical bases, from which the whole research originates. The second part of the article summarizes the practical information on the risk management process implemented by companies operating in the Czech Republic and identified by a questionnaire survey. At the beginning of the second part of the article, the table summarizes the data on respondents. These data include information on the size of companies, the number of employees the company employs, as well as information on the companies' scope and to which business sector the companies surveyed belong. Total 82 Czech companies attended the research.

The research was participated in by companies whose scope of activities is regional to multinational. Nationals companies prevailed with 47.6%. According to the number of employees in the survey, medium-sized enterprises predominated. As regards the sector to which the undertakings fell, first of all, the transport and storage prevailed. The questionnaire survey revealed that most of the companies surveyed carry out the risk management process by their employees and do not use external staff. Another question was whether one employee manages the company's risks or whether there is a multi-employee department. The majority of companies have only one employee to identify, assess, and analyse risks, and only 19.5% of companies have a multi-staff department for risk management. From the companies surveyed' responses, it was found that almost half of the respondents used the FMEA method to manage their risks, the What-If Analysis method, Scenario planning, and Checklist, and only a small number of companies used the HAZOP, ETA, and FTA method.

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# THE LACK OF RESPONSIBILITY FOR DIGITISATION IN MEDIA COMPANIES

*Lukas Bernfried Bruns*

## **Abstract**

Media companies in Germany have great problems to adapt their business model to the new requirements of digitalization. For such a large task, responsible people are needed within each company. This task, the distribution of responsibility, is not easy and often leads to a diffusion of responsibility. This phenomenon is fundamentally known and researched in psychology and the social sciences. This is not the case in relation to business enterprises, digitalization and in particular the media industry, which is very much affected by digitalization, and there are large gaps in literature and research. This paper tries to close this gap a bit. This article is also intended to enrich knowledge in classical change management, since the attention to the diffusion of responsibility is underrepresented in this research area. Furthermore, it shows the results of narrative interviews. The research demonstrates that Newspaper CEO's spread responsibility pluralistic within their companies and don't have a focus on the right management, to solve the old and the foreseeable problems.

*Keywords: diffusion of responsibility, digitalization, newspaper, change management*

## **1 INTRODUCTION**

Based on research of Burgelman and Grove (2012) we know that an existing company can lose its customers and its revenue, if strategic inflection points hits it too hard. However, that happens due to the change of industry dynamics, competition changes, strategic assets and changing markets and organizations can find themselves in the "valley of death". Moreover, that means within an industry lifecycle circle that a company rather make early radical change, adapts business model, acquires new competences and creates new strategy or a company attempts to cross with adjustments but shows no significant change. To conclude, in the first case a company expand with new growth market and in the second it collapses due to the lack of demand and revenue.

Can all that happen just to technological change and the digitalization?

For the comparison with German or many European newspaper publishers, the model described can certainly be applied, because in the last decades these newspaper houses were subject to massive market and technological changes (Küng, 2017). This change is not only explosive from a market perspective, but also from a political and social perspective. Pürer and Raabe (2007) explained that newspapers in Germany are not directly attributed to the democratic separation of powers. But nevertheless, in democratic theory the press is assigned a "public task", with which it creates benefits by e.g. control, criticism, contribution to the formation of opinion and information, and is supposed to fulfil this task. Therefore, newspapers make an important and indispensable public and social contribution.

Still, the business model of local newspapers is changing and is also jeopardized (Sjurts, 1996; Haller et al., 2014). Furthermore, disruptive competitors are entering the market and large global "digital media" groups such as Facebook, Google, Vice, BuzzFeed, News Corp. and Springer, are making use of readers, attention, coverage, and advertising expenditures. Due to the increasing digitalization and changing consumer needs media companies lack new business

models. In 1991, 27.5 million (m) newspapers (subscriptions) were printed and sold. In 2019, 13.5 million remained (Statista, 2019a). An entire market has shrunk by more than 50%. In addition, it is worth mentioning that the offers and products of digital media (of newspaper companies) have increased from almost zero in the 1990s to 698 in 2019 (Statista, 2019b). However, this fact does not solve the problem of decreasing newspaper subscriptions. Since 2012 almost all digital subscriptions of media companies are counted in the print and sales statistics (BNV). The new digital media world does not match the offerings of the traditional media providers. Consequently, these circumstances are not the best conditions for a growing newspaper media market. Even if a company and its management team are aware of the problems and challenges, this does not trigger the process of change. Just because everyone knows that there is a problem does not mean that everyone is taking care of the problem. As a result, the main question here is, who will take responsibility for this within the company? Moreover, there is the so-called phenomenon diffusion of responsibility. The diffusion of responsibility comes from the research of psychology and sociology. The phenomenon has become famous through behavioural research and the case of "Kitty Genovese" and the definition of the Bystander Effect (Manning, Levine & Collins, 2007). The Bystander Effect defines that the probability of assistance decreases when several witnesses observe a help situation. This happens because the presence of several potential helpers reduces the individually perceived responsibility (Alle & Mayerl, 2010). The bystander effect is very close, if not equal, to the diffusion of responsibility. It titles the phenomenon that if the more people know about a problem and also know that a lot of other people are aware of it, the more it can lead to that nobody reacts. It seems that the presence of other people makes employees feel less responsible for the outcome of group decisions, especially those with negative consequences (Zyzniewski & Giammanco, 2002). All in all, the number of "observers" can even worsen the situation.

In the new digital media world, "news" is not completely outdated. News consumption by media websites is ranked 11th among the most frequently used actions on the Internet (Germany). Around 25% of all citizens use the online offerings of media companies (Statista, 2019c). The problem is that they do not pay well enough for them (or not at all) and usually use only some main media websites. Furthermore, the statistics show that the total media consumption is not distributed among the various offers and websites of the media companies, but rather among a few major players in the market (Statista, 2020). This also means that media companies in Germany are forced to innovate and adapt old business models to new market requirements in the digital media sector. According Haller (2014), almost every publishing house and its senior staff know that the digital transformation is a threat. On the one hand, the need for digital transformation is completely obvious to everyone in this business sector, but on the other hand it also seems that media companies cannot clarify who is responsible for the transformation process. The hypothesis is that the media companies and the CEOs do not strategically focus on responsibility management. (H0 newspaper publishers and their CEOs do not have a strategic focus on responsibility management, H1 newspaper publishers and their managers have a strategic focus on responsibility management). It is therefore assumed that there is a latent diffusion of responsibility in the individual media companies. One further assumption is that media companies are not responding to the new challenges. Furthermore, within these companies it is not clear who will take on the responsibility for the realignment of the business model. Moreover, it is to be answered what the new business model is and whether there are answers to the requirements of customers and the changing market. This paper is a preliminary study for the development of a theses as part of a dissertation and the development of a questionnaire on responsibility diffusion.

## 2 THEORETICAL BACKGROUND

Küng (2017) describes the impact for media organizations in two ways. Consumers and technology are forcing the publishers to react on multiply areas. Consumers have less time for media consumption, more options and on top are less loyal to the known brands. In the technology area there are new platforms, new content forms and new content technologies. Furthermore, the organizations have to face more competitors and increase in volume and diversity of media products, flat growth and declining revenues, changing patterns of consumption and more complex value chains.

This description makes the need for change or readjustment to market conditions indispensable. A company must take action and people must act. However, clear responsibilities must be allocated and defined. Without responsibility and without allocation, tasks cannot be completed. Nevertheless, it is precisely with such complex and difficult tasks that inaccuracies and ignorance of the tasks arise.

This could for example happen due to pluralistic ignorance. Described by Vogelsang and Buchholz (2019), pluralistic ignorance refers to wrongly perceived preferences of others. It also influences one's own behaviour. In concrete terms, this phenomenon occurs when, for example, a large number of people observe a problem and then each individual observer assumes that there is no problem, since no other observer seems affected or does something and therefore does not act. In addition, the phenomenon describes a situation in which a majority of employees secretly rejects a standard, e.g. not tackling digitalization, but mistakenly assumes that the majority accepts the standard. Not infrequently, employees respectively people even conceal their opinion on a situation or problem because they think that they are alone with their opinion. Unfortunately, in the end, everyone has the same thoughts, only no one speaks them out. This fact does not make it easier to work through large and small projects.

Just because many people know that there is a problem, does not mean that they will address it. Maybe it will even get worse. Probably even, because the so-called diffusion of responsibility refers to the phenomenon that a problem or a necessity that needs to be solved or dealt with, despite sufficient knowledge, staff and attention, decreases the individual's sense of responsibility for dealing with it as the number of people involved increases (Maderthaner, 2017). Thus, when responsibility for a necessary action is divided among several people, the sense of the people themselves to be responsible decreases. These are no ideal conditions for completing projects quickly and efficiently. This is exactly where the profound problem lies. Because responsibility diffusion also means the ambiguous assignment of a task and a responsible body or person. This circumstance is often a classic management error, because the problems of feeling responsible often begin due to a lack of or unclear distribution and definition of responsibility or due to the mixing of tasks and objectives as well as internal competitive goals. It has also been studied by Goller and Bronnsack (2019) that the presence of other people leads to employees feeling less responsible for the outcome of group decisions, especially those with negative consequences. This phenomenon is known as "social loafing". The counterpart to social loafing is the "social facilitation theory", which shows that only the presence of others leads to less effort and performance in demanding tasks (Zajonc, 1965). In addition, the old Ringelmann model is interesting because the results show that people tend to work less hard within a group than their individual performance would be and that they are often less motivated when working towards a common goal (Lahmer et al., 2018). In relation to Karau and Williams (1993) it seems to be proven that all these effects occur on both sides of work, intellectually or physically. Last but not least, research shows that individual work done for a group work goal also leads to less motivation and effort. There are other building blocks that reduce the sense of responsibility of employees and colleagues. If, for example, their own

expertise for solving a problem is rated too low, people immediately feel less responsible. In addition, there must be a relationship to the problem. But when anonymity prevails around one's own "will", this is often the beginning of the end (Vanderslice, 1988). Moreover, responsibility is constantly shifted to people with a "closer relationship" to the problem. Another difficulty can be the bureaucratic corporate structure. If a problem has to pass through countless floors and hands, the solution often takes a lot of time or sometimes even finds no one responsible at all. Not to forget a well-functioning try and error culture. If people have to stand at imaginary walls again and again, or employees are not allowed within a company to try anything, a so-called learned helplessness can occur. This phenomenon shows that opinions developed through negative experience lead to loss of the ability to change one's own situation or problem (Gerrig, 2018). The consequence is: the employee stops his activities and his sense of responsibility. In addition, the perceived ability and power should be mentioned. If people do not feel capable of handling a complex task, it can lead to the transfer of responsibility to other "more capable" or "more powerful" people. It is therefore very important that people are familiar with the problem to be dealt with, have sufficient power and have the support of colleagues, superiors and the company.

### **3 METHODOLOGY**

In order to develop the right research design, it is necessary to deepen the knowledge of the topics described in the introduction. A literature research was conducted, the findings were collected and the results structured. To test the hypothesis, five interviews with CEOs of newspaper companies were conducted. In order to choose the right interview design, different interview methods were examined (Steiner & Benesch, 2018). From these interview designs, "narrative interview" was selected to collect data, find retrospectives of the events, uncover contexts of meaning, narrative theoretical knowledge and to find further hypotheses. In the mid-1970s Fritz Schütze introduced the "narrative interview" as an established and well-founded qualitative research instrument (Przyborski & Wohlrab-Sahr, 2013). According to Holtgrewe et al. (2009) the narrative design functions as a proven technique of data collection. The goal of a narrative interview is to challenge the respondent to give a narrative or narrative answer by asking an almost open-ended question. This means that he or she retells experiences of events, testimonies and knowledge as they occurred. It should be mentioned that narrative interviews always have a retrospective character (Küsters, 2009). For example, it is not about clarifying exactly how CEOs behave at the moment in their company, but rather which terms and conditions led to the situation in which they find themselves nowadays (Küsters, 2009). A key factor could be that by illustrating the process (from the interview, what happened in the past) specific or universal problems can be identified.

The aim of the narrative interview is to provide a basis for capturing, understanding and explaining the research questions from the perspective of the interviewee. According to Wollny and Marx (2010) decisive advantage of the narrative interview is that the researchers make as few restrictions as possible in advance, so that the respective relevance is determined solely by the respondent. Associated with narrative design and the narrative interview is the idea "that the narratives are oriented more towards concrete courses of action and less towards the ideologies and rationalizations of the respondents" (Hopf, 2004). It should be mentioned that without the narrative of an event or an experience related to the topic, the possibility of opening up latent patterns of interpretation and subjective constructions of meaning remains closed (Wollny & Marx, 2010).

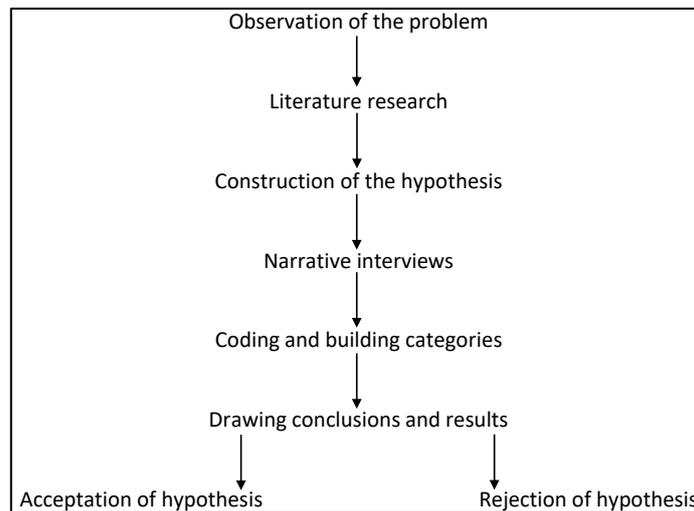


Fig. 1 – Methodology flow chart. Source: own research

In relation to Misoch (2019) the narrative interviews were conducted in eight steps. It begins with the request for narration and the question: "I would like to ask you to tell me how you have seen the digital transformation of newspaper publishers in recent years or decades. It's best to start with the beginning of the transformation, with the individual hurdles in the market, and then tell me everything that has happened step by step up to the present day. You can take your time, even for details, because everything that is important to you is interesting to me". Here a narrative incentive is set for a special and concrete situation. Second point is the autonomous narrative and the answer. The third part is the inquiry phase where the narrative survey is conducted by the person interviewed. Afterwards the balance phase begins. An evaluation, the theoretical statements and the development of subjective theories must be described and noted. Step five is a second request for narration with the question:

"Who in your company is responsible for digitization, who was responsible for it and how do you deal with the distribution of responsibility today? Step six is a repetition of phase 2-4 and is followed by an open discussion (additionally inserted) and will end with step eight the evaluation, where the fully transcribed interviews are then evaluated using narrative-structural methods and qualitative content analysis (Misoch, 2019). Ultimately, the function of the interview evaluation is not only to test research hypotheses, as is the case with common quantitative methods or various other research designs. Rather, the interview is preceded by the formulation of an open research question. The hypotheses are then derived from the interpretation of the interviews conducted.

### Coding

Following the interviews, these were transcribed and pauses for thought, emphasis and mentioned particularities were identified and marked. Subsequently, different order categories were developed. In these first coding procedures the texts were translated into coded text. This involved shortening and generalizing of the interview sections. Finally, 54 different codes were segmented and juxtaposed in a disorderly fashion. The development of the codes is subjective and at one's own discretion. Subsequently, a reordering was carried out, the codes were evaluated and rearranged according to meaningfulness, relevance, thematic and content overlaps. These open coding steps are additionally processed according to the so-called W-questions (Hülst, 2010) (lines, sentence and section). Finally, a thematic coding was carried out, in which similarities and differences in the interview answers and persons (groups) were identified. Following that, categories were defined and selected. After a re-analysis of these

codes and the diverse answers of the interviewees, own interpretations were created. The categories are: “technical possibilities”, “what does the customer want”, “balance sheet and turnover”, “subscription and core product”, “who is responsible” and “distribution of responsibility”. These six categories were collected together with the corresponding statements and considered as an overall construct. Finally, categories 5 & 6 were reassembled in the interpretation.

## 4 RESULTS

The coding process and the six categories have generated a variety of insights. Starting with the “technical possibilities”. Most of the managing directors have very little confidence in their company's own technical competence (interviewee (I): "We have incredibly bad IT", "...there were colleagues from America who said we were still in the "Gutenberg" age when it came to the digitalization of news"). Nevertheless, technology is seen as the key to success and this success will, if, be digital. Many technical problems from the past are still interfering with the processes and the work of digitization and the reorientation of the core products. (I: "...use of scaling possibilities, be it in IT, be it in the operation of platforms, if we succeed, we have a chance of survival at a much lower level"). The need is recognized, but is not fought with full passion. It is suspected that the managing directors themselves, see the technical foundation not yet given (I: "So probably less paper and more bits and bytes.") and also in terms of content are not deeply familiar with the technical possibilities. However, there is an awareness of the need to catch up in terms of software, technology and digital know-how.

“technical possibilities”,	“what does the customer want”,	“balance sheet and turnover”	“subscription and core product”,	“who is responsible” and “distribution of responsibility”
<ul style="list-style-type: none"> <li>• Most of the managing directors have very little confidence in their company's own technical competence.</li> <li>• Many technical problems from the past are still interfering with the processes and the work of digitization and the reorientation of the core products.</li> <li>• There is an awareness of the need to catch up in terms of software, technology and digital know-how.</li> </ul>	<ul style="list-style-type: none"> <li>• The focus is clearly on local news. The old answer/solution for satisfied and paying readers should also be the new digital answer.</li> <li>• The goal is to get digitally paying customers with local content. It is seen as the only chance.</li> <li>• There is a strong internal company view and no thought is given to digital and new competitors.</li> </ul>	<ul style="list-style-type: none"> <li>• The business model and the balance sheets as well as the main revenue drivers have not changed despite digitalization.</li> <li>• Newspaper publishers today are more dependent than ever on the old business model and newspaper printing.</li> <li>• Even the digital offerings such as the newspaper in electronic form are not enough to maintain or expand the balance sheets and sales from the past.</li> </ul>	<ul style="list-style-type: none"> <li>• It is clearly evident that the publishers are watching each other closely and want to benefit from the ideas of others.</li> <li>• Neither managing directors' self-responsibility of the necessary changes is subject of discussion, nor of what influence they could or should exert themselves.</li> </ul>	<ul style="list-style-type: none"> <li>• With one exception, the managing directors consider themselves not to be primarily responsible for digitization in their publishing house.</li> <li>• Four out of five managing directors state that "all" or just the respective managers are responsible for the digitalization.</li> <li>• There are no clear answers, no details and no comments on "who is responsible for what" and "what is to be achieved".</li> </ul>

Fig. 2 – Categories and results overview of the narrative interviews. Source: own research

The results for the second category "what does the customer want" are to be evaluated differently. Here, there is a uniform opinion about the content orientation of newspapers. The focus is clearly on local news. The old answer/solution for satisfied and paying readers should also be the new digital answer. The disadvantage is that no new ideas are mentioned by the "content-related local" and no alternatives are seen or mentioned. (I: "Let's go to the boot camp of local relevance, it's a process of several years, if we succeed, we have a chance. If we don't succeed, we don't have a chance", "Because we still have the cover in most German newspapers, i.e. that covers everything, we are doing something very wrong from my point of view, namely we are not focusing on our core competence, which is the local, I say explicitly local and not regional, because identity is done through the local and not through the regional"). Occasionally, but also by consensus, the topic of service is mentioned in an undefined way.

What this means in detail for the core product newspaper and digitalization remains unanswered. (I: "From then on, digitalization will have to take service to the extreme. But we don't really know what we are doing there either"). The goal is to get digitally paying customers with local content. It is seen as the only chance. There is a strong internal company view and no thought is given to digital and new competitors or fears that new digital market participants will emerge. The barriers to market entry can be very low in the digital world.

There are clear signs of no change in primary revenue and business model recognized out of the category "balance sheet and revenue". Moreover, the business model and the balance sheets as well as the main revenue drivers have not changed despite digitalization.

(I: "in the last 10 years, speaking as a businessman, a balance sheet of a regional newspaper has not changed at all, despite the permanently proclaimed digital transformation, the core business remained, the printed newspaper remained, the advertising papers, um, it was subscribed, a piece by piece through additional logistics services such as private letter service, um, but basically the core, um, the newspaper has remained the main carrier of the business model for all, even for the large regional newspaper houses and groups"). Newspaper publishers today are more dependent than ever on the old business model and newspaper printing. (I: "If I halve my turnover, I can no longer afford to print and distribute paper, because that's about, if I include everything, with depreciation and energy, 50% of my cost apparatus. So, also, if I am extremely successful digitally, according to my thesis, at some point the turnover is halved, I can no longer afford printing and I have to anyway focus on my core competencies"). Even the digital offerings such as the newspaper in electronic form (e-paper) are not enough to maintain or expand the balance sheets and sales from the past. (I: "Even if we do now, we're already doing that, we've had the hard paywall for many years now. From then on, we are still not even near where we want to be, or where we think we are"). The statements contradict the claim to operate digital local journalism and to earn money with the core product in the future. The knowledge is there that the old business model will no longer be viable in the years to come. But the upheaval has not been achieved. (I: "Need not great enough, as there is still enough money flowing.").

With the following point "subscription and core product" the problems are branched out. There is a lot of blaming in the companies and the belief in the change of the subscription circulation and the core product newspaper and local journalism is mostly not pronounced.

(I: "My thesis is that the local editorial offices of the German regional newspapers or local newspapers are usually not equipped in such a way, even mentally, from the attitude of the editors that they really struggle for relevance every day, but they still get entangled today in chronicler's duty, in many routines and do not ensure that the core competence is actually the best product. ", "We must certainly bring the supra-regional, economy and such things, but we are not an elite medium there, we are a generalist medium and what is not our core competence is the Swiss Army Knife, it must be able to do everything, but it is not a special tool", "Well, I actually believe that regional units are needed to provide information").

Neither managing directors' self-responsibility of the necessary changes is subject of discussion, nor of what influence they could or should exert themselves. Instead, there is much talk about technology, which is supposed to act as a saviour. (I: "The digital transformation is, uh, is a lot of technology, uh, technology has not been the competence of regional newspapers so far, I believe that this will be one of the essential points that the regional media houses will have to deal with, that in addition to the editorial office, technical know-how will also be necessary, uh, and editorial work will also become increasingly technical in terms of all the arithmetic behind the direct contact with the reader. Um, however, if this becomes generally accepted, then I am convinced that the regional information provision business can be, um,

mapped as a business model in the future"). The answers from the interviews and the discussions regarding the observation of other local publishers were serious. Here it is clearly evident that the publishers are watching each other closely and want to benefit from the ideas of others. (I: "Not finding a good solution for yourself, but simply copying again because you don't have a solution yourself yet. For yourself, that is, what you want to do").

The last two categories, "Who is responsible" and "Distribution of responsibility", have been merged again as described in the interpretation and analysis in order to obtain a more condensed overall picture. With one exception, the managing directors consider themselves not to be primarily responsible for digitization in their publishing house. (I: "...we have actually decentralized this responsibility to our, yes, departmental managers"). Four out of five managing directors state that "all" or just the respective managers are responsible.

(I: "Mhhh, but we don't see ourselves as responsible only for the daily newspaper but for everything - everyone", "everyone is responsible for digitization, actually, every employee is responsible in his or her actions what he or she does here", "we are all responsible for digitization", "In the past, the digital head was responsible for digitization, today it is a mixture of editorial and sales departments which are actually more closely interlinked").

It seems that the managing directors have not given it much thought until today and also do not focus on the topic. The answers were also very brief and were not emphasized or explained much. The statements found are relativizing self-responsibility. There are no clear answers, no details and no comments on "who is responsible for what" and "what is to be achieved". The responsibility is simply distributed pluralistically. With regard to the responsibility of digitization, one can also speak of a laissez-faire approach and that the belief prevails that "things/digitization" will be found and dealt with. In addition, the acceptance of the task and challenge is not mentioned at all. Only one managing director views the responsibility differently and in a more reflective way. (I: "At the end of the day, the management is responsible for setting the course", "That's a bit of a cute picture, but I think it characterizes it quite well that it is incredibly difficult to delegate responsibility in such a way that I, as the managing director, cannot get out of it now, that must not happen, but that the people, what they usually complain about when they sit together in the canteen at lunchtime, can now change it themselves. And it is my job, or the job of leadership, to create a framework and orientation, in other words to describe the green field. "But now get out of your stable!").

## **5 DISCUSSION AND CONCLUSION**

This study examines the distribution and diffusion of responsibility in the digitization of medium-sized German local newspaper publishers. It should be noted that German newspapers must adapt their business model to the new digital requirements of the market in order to continue to function as an important democratic pillar. Furthermore, the companies are forced to maintain their business segments and yet transform them digitally. A company must take responsibility for this process. It was examined how this responsibility is distributed and whether the publishers or the managing directors focus on controlling the responsibility.

Consistent with the findings of this study, there are already several studies indicating that individuals tend to feel less responsible when decisions have to be agreed upon in a group and if it is to be put into action, even when all individuals are pivotal to implement the responsible action (Irlenbusch & Saxler, 2019). There is a multitude of indications that there is a latent diffusion of responsibility in the individual media companies. This is evident, for example, in the un-reflected fundamental distribution of responsibility among "all". The results of the research and the analysis of the interviews have shown that the hypothesis (H0) can be verified. The results and statements can be clearly interpreted and there is sufficient oral evidence. The

media companies and the CEOs do not strategically focus on responsibility management. It is said that digitalization threatens the business field. It is also said that newspaper publishers have not yet completed the transformation, to digital newspaper local publishers, and are still today predominantly dependent on the print product. Furthermore, regarding Humborg and Nguyen (2018) this business model has collapsed or at least shown weakness in recent years - against the background of a far-reaching structural change that is significantly, but not exclusively, related to the distribution of digital media. Additionally, the H1 hypothesis is dropped, albeit with limitations. There are also publishers or managers who are aware of their responsibility. Furthermore, the number of interviews is too small to speak for an entire industry in general.

Counterarguments against the assumed H0 hypothesis can be identified through the work of El Zein, Bahrami and Hertwig (2019). They have determined that, making difficult decisions with others shields individuals from the consequences of negative outcomes by reducing regret, punishment and stress. This can be an important factor in successfully moving a task such as digitalization forward. A further assumption is that media companies are not responding to the new challenges. The results show a picture of no reaction from the publishing houses. It is consistent with Hoppe and Daum (2020) who have discovered: “for three decades now, the newspaper industry has been undergoing profound structural change, which will be further intensified by the digital transformation”. In the newspaper companies is clarity about customer demands and the future business model - the local journalism. However, the question of which digital channels and in what way remains unanswered. Moutchnik (2018) argues that the conflict between the “old” (paper-based) and the “new” (digitalized) media has become overwhelmed by the media themselves. In addition, within most companies it is not clear who will take responsibility for the reorientation of the business model. Many business leaders did not give clear statements regarding the help of technology. Here, only generalist answers were given. Christensen (2000) has researched that all new or sustaining technologies improve the performance of established products. Publishers should therefore take advantage of this opportunity. Finally, the managerial relevance is, that almost every company can have the problem of diffusion of responsibility and that this phenomenon is not well known within the media companies (CEO's). Only a phenomenon that is recognized and considered a problem can be solved. Responsibility must be clearly regulated and also the responsibility for each task needs a responsible person.

Eventually, the own interpretation of the statements and interviews must be seen critically. These are subjective and can be interpreted differently by other researchers. Another criticism is the insufficiently applied Grounded Theory in the method. Due to the brevity of the interviews, the network of different codes did not become large. Therefore, only 6 categories resulted for the analysis, which were classified as relevant. This helped to cope with complexity. Of course, further insights could be gained from the results and interviews. However, this would go beyond the scope of this research question. Nevertheless, new hypotheses for further research can be established. (Ho: Diffusion of responsibility has no negative influence on the digitalization of the business model of German newspaper companies.).

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# SELF-EVALUATION OF THE LEVEL OF KEY COMPETENCIES FOR INDUSTRY 4.0

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## Abstract

The aim of the article is, based on the research, about the readiness of the level of key competencies of managers and employees in various job positions for Industry 4.0. The authors of the article chose the key competencies for Industry 4.0 based on the literature review. Key competencies for Industry 4.0 are digital competencies, innovation, creativity, cooperation and teamwork, communication skills, problem solving, decision making, lifelong learning and leadership. The contribution of this work is the determination of key competencies for Industry 4.0 based on the comparison of literary resources and on the basis of self-evaluation from the survey, the readiness of the level of key competencies for Industry 4.0 of managers and employees in various characteristics. The statistical survey revealed that the managers and the employees who use modern technologies for Industry 4.0 have the highest level of self-evaluation in mastering the competency cooperation and teamwork (8.17 from 10-point ordinal scale). On the other hand, the lowest level of self-evaluation of the competency Leadership (6.65 from 10-point ordinal scale) was found. The characteristics of key competencies were obtained by using the average, p value Kruskal-Wallis Test. In the case of the first hypothesis, the H<sub>0</sub> hypothesis was not confirmed for the type of the job position in the organization for the leadership competency. The leadership competency is statistically significant. According to the Mann-Whitney U Test, the administrative staff self-evaluated the level of Leadership competency worse than other categories of staff (top management, middle management and specialists).

**Keywords:** *Industry 4.0, key competencies, human resource management, digitalization*

## 1 INTRODUCTION

As a part of the recent high-tech strategy of the German government mentioned by Hecklau et al. (2016), the term Industry 4.0 is often referred to the fourth industrial revolution. Industry 4.0 is introducing rapid and epochal changes and challenges especially in digital world. From the economic perspective, according to Kidschun et al. (2019) the digital transformation has a significant impact on organizations of all sectors. The development of products and services is changing as well as the interaction with customers, partners and suppliers. As these changes create new requirements for organizations, they need to re-orientate and adapt to these requirements. Due to the continuous automation of simple manufacturing processes, the number of workspaces with a high level of complexity will increase, which results in the need of high level of education of the staff. As reported by El Attoti et al. (2019) if organizations start to digitize, they must engage with a digital transformation. We approach to the term Industry 4.0 and digitalization similarly as Hecklau et al. (2016), who describe this concept of Industry 4.0 as the increasing digitization of the entire value chain and the resulting interconnection of people, objects and systems through real time data Exchange. This concept Industry 4.0 is described as a digitalization and a comprehensive chain of collaboration between systems and people.

In order to succeed in the Fourth Industrial Revolution based on the research by Vrchota et al., (2019), organizations need to prepare their employees for the following competencies using

new methods and technologies that will be the key elements of industrial work 4.0, improving new forms of organizational structures related to processes and personnel issues, enabling new human role Industry 4.0. Similarly, Prinz et al. (2016) approach to the human role in Industry 4.0 with the increasing requirements of the key competencies in the social, methodical and personal areas. El Attoti et al. (2019) approach to the business environment with high demand on managers and employees who work in the organization at all managerial levels. Therefore, these managers and employees should have the right key competencies to deal with the digital transformation for Industry 4.0. By accelerating the production, innovation and economic processes, Hecklau et al. (2016) specifies the integration into Industry 4.0 to further automate and enhance the skills that are needed, when simple and monotonous processes are automated, while other processes become more complex and intertwined.

The constant pressure to improve the qualifications and the key competencies in the conditions in Industry 4.0 is a topical issue that will determine the main competitive advantage of organizations in the next five years. Utilizing Industry 4.0 is a unique opportunity to ensure the long-term competitiveness in the global environment. According to Vrchota et al. (2019) in terms of employment in High-tech and Medium-high-tech areas, the Czech Republic is one of the leaders in the EU. The level of computer skills in the Czech Republic are increasing. Connection to the internet is around 80%. The share of technical workers in the Czech Republic is within the range of 30 – 40%. This view extends Hecklau et al. (2016) with an emphasis on successfully managing these changes, the strategic management of key competencies becomes essential. From the authors point of view, the Czech Republic also needs to respond to these trends in order to deal with the development of key competencies for Industry 4.0.

## **2 THEORETICAL BACKGROUND**

### **The Definitions of the Term Competency**

There are numerous definitions of the term competency. The distinction between competency and knowledge or skills is often unclear.

In the view to the history, Sinclair (1995) defines “competency” as the ability to do something well or effectively. Man, Lau and Chan (2002) set definition of competencies as the total ability of the managers and employees to perform a job role successfully. From the point of view Volpentesta a Felicetti (2011) the term competency can be understood as a relation between an individual and tasks to be done within professional work. Consequently, it is the knowledge and skills that are required for effective execution of a specific task. “The competencies are defined as a set of a combination of organisational, behavioural and technical skills which give the managers and employees the potential to implement the prescribed processes effectively.” (Patalas-Maliszewska & Kłos, 2017) “Competency is hereby based on the activation, combination and use of personal resources that can be developed (such as knowledge, networks, cognitive and practical skills) as well as on social aspects or behaviour, but not on a person’s character. Knowledge as well as cognitive and practical capabilities are necessary for the development of competencies.” (Kinkel, Schemmann & Lichtner, 2017) “The key competencies are observable or potential behaviour, whereby managers and employees could demonstrate not only their knowledge, skills, attitudes or the synergy among them, but also their personal attributes, adding value and better results to themselves, other individuals and teams, departments, organizations or networks, in harmony with the context, available resources and adopted strategy.” (De Freitas & Odelius, 2018) Based on various definitions that were developed in recent years, we use the term competency to define the managerial and employee dispositional ability and readiness to act successfully and self-organized when facing

novel, unstructured or complex tasks and the ability to develop solutions for future situations that are characteristic for Industry 4.0.

### **The Key Competencies for Industry 4.0**

As reported by Kaasinen et al. (2020), the managers and employees should have a smooth and clear user experience for Industry 4.0. The adaptation of the system is needed to be able to recognize the different skills and capabilities to provide information that managers and employees facilitate the production run accordingly. On the other hand, a very positive trend can be observed by Jaschke (2014) that Industry 4.0 will radically transform workers' job and competency profiles. Therefore, it will be necessary to implement the appropriate training strategies and to organize work in a way that fosters the enabling lifelong learning. Based on this framework by Canetta, Barni and Montini (2018), the consequences of digitalization in shaping a new working environment are analysed focusing on the managerial and employee impact, looking at the modification of both performed tasks and the required key competencies, as well as to the more generic social consequences (job satisfaction, work-life balance, new forms of employment). Especially for Industry 4.0 according to Colombo and Grilli (2005) the successful exploitation of a new business opportunity generally requires the integration of complementary context-specific knowledge (knowledge relating to technological, marketing, and managerial knowledge) that is dispersed among different managers and employees. In terms of the access integration key competencies for Industry 4.0. Romero et al. (2016) refer to those smart and skilled managers and employees of the future, who will be assisted by the automated systems that provide a sustainable relief of the physical and mental stress and allowing the managers and employees to utilize and develop their creative, innovative and improvisational skills, without compromising the production objectives. Imran and Kantola (2018) revealed that organizations are shifting their interest towards those employees making creative and innovative contributions and, at the same time, demonstrating excellent soft skills. Overall, it requires new skills, knowledge and competencies to manage these technologies as well as require more flexible working environment in the organizations.

One of the key requisites for success is choosing the right people for the right jobs. Choosing the right managers and employees with the required key competencies (knowledge and skills) is primary. The development of Industry 4.0 towards digitalization and its impact on the managers and employees has been surveyed in several studies and with different objectives (Fantini et al., 2016; Spottl, 2017; Hecklau et al., 2016; Shatunova et al., 2019; Collet, Hine & du Plessis, 2015). The results of the studies show that the current state of the implementation of Industry 4.0 does not yet allow a reliable determination of the development of the need for skilled workers. Based on the MPO (2020) research, it is important to realize the changes that the industrial revolution is bringing to a major impact on employment and labour productivity, thus the entire development of society, may be particularly at risk for less qualified managers and employees, but on the contrary they may bring new job qualification requirements. Retraining and further education will be a necessity for those who will still want to be successful in society. As reported by Fantini et al. (2016), understanding how the employees can be better integrated to enable the increased flexibility in manufacturing systems is a prerequisite to allow for the technological solutions, as well as humans, to harness their full potential. Humans can supervise and adjust the settings, be a source of knowledge and key competencies, can diagnose situations, take decisions and several other activities influencing manufacturing performances, overall providing additional degrees of freedom to the systems. However, Spottl (2017) claim that all findings of the studies agree upon the fact that employment opportunities for low-qualified workers will decrease, along with the implementation of Industry 4.0. On the other hand, the authors of this article have the opposite attitude according to the relevant research

publications Hecklau et al. (2016), Shatunova et al. (2019), Collet, Hine and du Plessis (2015). A higher need of companies for trained skilled workers and academically qualified staff is predicted. The mentioned figures were, however, only rarely collected in an empirically valid way. As stated by the Ministry of Industry and Trade of the Czech Republic MPO (2020) employees and managers will need good soft skills, the ability to learn new things, to improvise, to be flexible and creative. Communication skills, comprehensive problem solving, critical thinking, creativity and people management will continue to be important for future applications. As confirmed after the literature research by authors of this article, similar as Kravcik et al. (2018) who mention, that key competencies for Industry 4.0 are combinations of IT key competencies (mainly data analysis, IT security and protection) with social skills (including cooperation, communication abilities) and personal abilities (like lifelong and self-regulated learning, analytical ability, interdisciplinary thinking, problem solving). However, compared to Industry 4.0 visions, the managers and employees did not have many possibilities to utilize and develop their creative, innovative and improvisational skills, as suggested by Romero et al. (2016). Bogoviz et al. (2019) describe the most important specific feature that distinguishes Industry 4.0 from the traditional industrial production is the absolute integration (close interconnection) and interactivity (adaption to the situation in real time), ensured by means of modern digital technologies skills. Compared to Gudanowska, Prieto and Törmänen (2018) revealed that workers for Industry 4.0 should have a better managerial and employee knowledge as well as technical skills. The employees should have highly developed communications skills, be dedicated to precise task completion and be able to work autonomously as well as in a team. They should also be open to exchange and sharing of knowledge and experience. To summarize, from the point of view of Grzelczak, Kosacka and Werner-Lewandowska (2017), the key competencies of managers and employees in a modern enterprise will be primarily concerned with understanding issues and concepts from other disciplines and will be open to change and novelty. The authors claimed, that communication and intercultural skills, often used with virtual tools, will be more important. The authority of the Engineer 4.0 will still be based primarily on hard, technological knowledge, but the importance of soft skills will be continued to grow.

### **3 METHODOLOGY**

The aim of the article is, based on the research, the readiness of the level of the key competencies of the managers and the employees in various job positions for Industry 4.0. To identify the key competencies for Industry 4.0, the procedure according to the following sub-objectives was chosen.

#### **The first partial goal: the definition of key competencies for Industry 4.0 based on the literature review.**

The authors proceeded according to Tonelli et al. (2016) and evaluated the occurrence of the individual competencies from the computer search in the articles listed in the following 4 databases: ScienceDirect, Scopus, Emerald and Web of Science. To define the key competencies for Industry 4.0, the authors selected publications dated from 2011, when the term Industry 4.0 was first officially introduced in Hannover. The authors' strategy was to identify those articles that included "Industry 4.0", "The fourth industrial revolution", "Competency" or "Skills" as the main subject headings or text words in the title or in the paper. To collect the broadest array of relevant studies, the authors included keywords that were directly related to their research, as well as the synonyms of each concept. Additionally, the authors considered the various synonymous of each of these terms. A single search consisted

of a keyword combined with the term “Industry 4.0”, “Competency” or synonyms of this term using “AND”.

For the definition of key competencies for Industry 4.0, the authors used a systematic literature review to identify, classify and analyse current knowledge and proposing recommendations for future research in this area. We proceed similarly to Hecklau et al. (2016) and Patalas-Maliszewska and Kłos (2018) who analysed the defined sets of competencies and described the significance of each competency through references.

**The second partial goal: the determination of the development of selected competencies of the managers and the employees according to the selected characteristics.**

The results reveal that most papers are conceptual, with studies still lacking. It refers to the labour changes around working conditions, the work environment and new skills which are required.

Based on this study, and in order to describe the key competencies for Industry 4.0, the survey data were collected from 45 managers and employees of selected occupations from the Czech Republic participated in the questionnaire. Conceptually and empirically, the measures are based on the evaluating the utility of the key competencies in condition of Industry 4.0. Key competencies are measured on the least ordinal scale (in our case 10-point scale). The specific quantitative results of the assessed key competencies are presented as the average of all assessments of the given respondents. We proceeded similarly to Mitchelmore and Rowley (2010) taking an antecedent perspective by attempting to delineate key knowledge or abilities thought to reflect the key competencies, based on reviews of literature, and then having respondents self-assess their own level of mastering their key competencies. In the survey according to Deutskens et al. (2004) for added validity, the respondents were also given the opportunity to write absent key competencies from the survey.

The following hypothesis were set for the fulfilment of the second partial goal of the article:

1. Hypothesis: The level of the key competencies of development for Industry 4.0 depends on the job position in the organization of the respondents.

*H0: Assessment level of selected key competencies does not differ according to the job position in the organization.*

*H1: Assessment level of selected key competencies differ according to the job position in the organization.*

2. Hypothesis: The level of the key competencies of development for Industry 4.0 depends on the years in the given job position of the respondents.

*H0: Assessment level of selected key competencies does not differ according to the years in the given job position of the respondents.*

*H1: Assessment level of selected key competencies differ according to the years in the given job position of the respondents.*

3. Hypothesis: The level of the key competencies of development for Industry 4.0 depends on the size of the organization.

*H0: Assessment level of selected key competencies does not differ according to the size of the organization.*

*H1: Assessment level of selected key competencies differ according to the size of the organization.*

To verify the hypotheses, the non-parametric Kruskal-Wallis test at a significance level of  $\alpha = 0.05$  is used. If the H0 hypotheses are not confirmed (test criterion H is exceeded), the Mann-Whitney U Test at a significance level of  $\alpha = 0.05$  will be used for statistically significantly different pairs of monitored traits.

## 4 RESULTS

The results are divided into three parts, respectively the results of two partial goals set out in the methodology of the article and the questionnaire survey of respondents. For the second goal, the established hypotheses are confirmed or refuted.

### The definition of the key competencies for Industry 4.0 based on the literature review (the results of the first partial goal)

For the purpose of this article, the authors listed in Tab. 1 most often cite these nine key competencies for Industry 4.0 in the mentioned scientific articles.

Tab. 1 – The Literature Review of the Key Competencies for Industry 4.0. Source: own research

Literature source*	Key competencies for Industry 4.0								
	Digital competencies	Inovation	Creativity	Problem solving	Communication skills	Cooperation teamwork	Decision making	Lifelong learning	Leadership
Hecklau F. et al. (2016)	*	*	*	*	*	*	*	*	*
Morgan (2015)					*			*	
Mitchelmore & Rowley (2010)	*			*			*		*
Pellegrino et al. (2013)				*	*	*		*	*
Collet et al. (2015)	*		*		*	*		*	*
Shatunova et al. (2019)	*		*			*	*		
Patalas-Maliszewska, J. & Klos, S. (2017)	*		*	*	*	*			
Liboni et al. (2019)	*				*	*		*	*
Kinkel et al. (2017)	*	*	*	*		*			
Kaasinen et al. (2020)		*	*	*	*				
Bogoviz et al. (2019)	*	*	*						
Imran, F., & Kantola, J. (2018)	*			*	*	*	*		
Vodenko, K. V., et al. (2018)				*	*	*	*		
Grzelczak et al. (2017)	*	*	*	*	*	*	*		*
Spottl (2017)	*	*			*	*	*		
Kravcik, M., et al. (2018)	*			*	*	*		*	
Fareri, S., et al. (2020)	*	*		*					*
Vrchota J. et al. (2019)	*	*	*	*	*	*	*	*	
Prinz et al. (2016)	*			*	*				*
Gudanowska et al. (2018)	*	*		*	*	*	*	*	*

The following competencies are most often mentioned in the literature: digital competencies, problem solving, communication skills, cooperation and teamwork. On the other hand, these competencies for Industry 4.0 occur the least often: innovation, creativity and lifelong learning.

### Self-evaluation the level of key competencies for Industry 4.0

Based on the research with 45 experts, the lowest level of self-evaluation of the competency leadership was found. In Fig. 1 below, the average value of the 10-point scale for the leadership competency is only 6.65. This means that the experts have the least confidence in mastering this competency leadership. On the contrary, experts in self-evaluation believe the most in mastering the competency cooperation and teamwork, where the average value of this competency is 8.17.

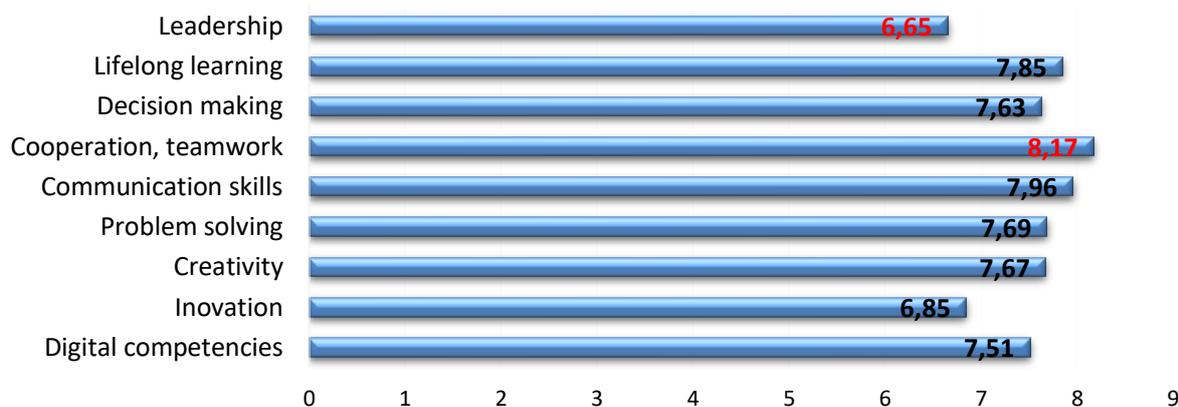


Fig. 1 – The Self-evaluation the Level of the Key Competencies for Industry 4.0. Source: own research

### The determination the development of selected competencies of the managers and the employees according to selected characteristics (the results of the second partial goal)

To fulfil the second goal, our approach was made from the hypotheses set out in the methodology of this paper. The results show that the H0 hypothesis was not confirmed only for the feature of the job position in the organization (Tab. 2). The authors suggested, the job positions are divided to the top management (the directors or the owners); the middle management (represented by the financial manager for example, which means the head of finance department); the specialists (such as the project manager, the marketing specialist, etc.); jobs in administration (represented by the accountant, technical assistant, etc. for example).

Tab. 2 – Kruskal-Wallis Test. Source: own research

Competency / Job position in the organization	Top management	Middle management	Specialist	Administration	Average for the whole sample	Kruskal-Wallis test p value
Digital competency	7.50	7.09	8.15	6.89	7.57	p =0,0994
Inovation	7.75	6.92	7.30	5.33	6.84	p =0,1038
Creativity	7.50	7.58	8.10	7.00	7.69	p =0,8157
Problem solving	8.75	7.50	7.95	7.11	7.73	p =0,2071
Communication skills	8.25	7.58	8.15	7.89	7.96	p =0,6760
Cooperation, teamwork	8.00	7.67	8.60	8.00	8.18	p =0,5675
Decision making	8.00	8.17	7.45	7.11	7.62	p =0,5978
Lifelong learning	8.25	8.42	7.70	7.33	7.87	p =0,3495
Leadership	8.50	7.17	7.05	4.67	6.73	p =0,0039

The following graphs show the medians, upper and lower limits of the self-evaluation distribution for the monitored leadership and digital competencies. Mann-Whitney U Test at a significance level of  $\alpha = 0.05$  was used to determine the difference of character pairs. There are statistically significant differences (H0 hypothesis was not confirmed) in the self-evaluation of the leadership competency in the group of the administrative staff (number 4 in Fig. 2 on the horizontal axis) from all other groups (the p-value between the administrative staff and the top management category (number 1 in Fig. 2 on the horizontal axis) is 0.0079; middle management category (number 2 in Fig. 2 on the horizontal axis) is 0.0085 and specialist category (number 3 in Fig. 2 on the horizontal axis) is 0.0026. The leadership competency is statistically significant.

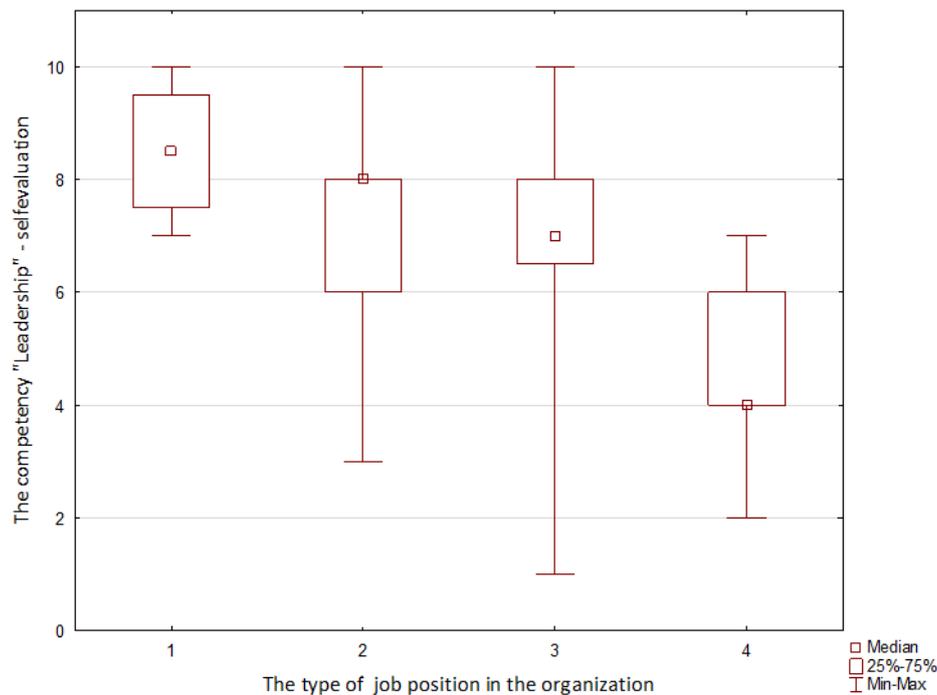


Fig. 2 – The box graph for the competency leadership by the job position. Source: own research

Fig. 2 shows the administrative staff rate the level of the leadership competency worse than other categories of staff.

A milder dependence of the observed character can also be observed in the digital competency (Fig. 3). The administrative staff (number 4 in Fig. 3 on the horizontal axis) considers this competency to be less developed than specialists (number 3 in Fig. 3 on the horizontal axis). Fig. 3 shows the number 1 - top management and the number 2 - middle management on the horizontal axis. For Digital Competency, the Mann-Whitney U Test can only be used to prove the difference between the job positions “administration” and “specialist”, where p value is 0.0363. The administrative staff considers this competency to be less developed than specialists.

For fulfilment the second and the third hypothesis according to the average, p value Kruskal-Wallis Test, the H0 hypotheses were not refuted. It's the fact, that H0: Assessment level of the selected key competencies does not differ for self-evaluation of the level of key competencies for Industry 4.0 according to the years in the given job position of the respondents and the size of the organization.

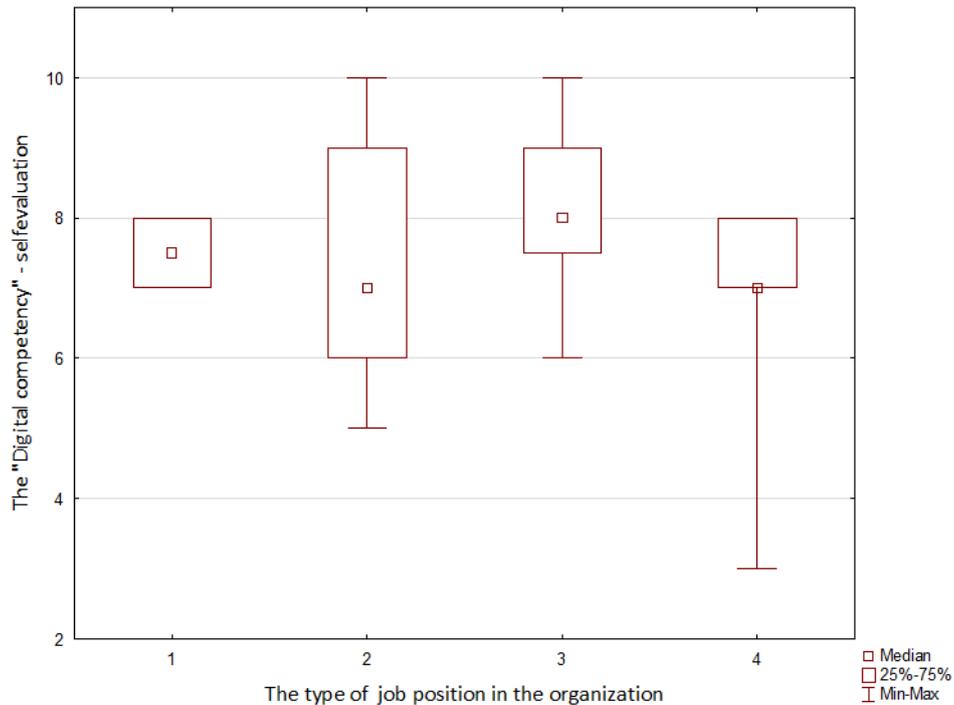


Fig. 3 – The box graph for the digital competency by the job position. Source: own research

## 5 DISCUSSION

Similar to Liboni et al. (2019) we found that the topic “competencies for Industry 4.0” is the central theme of the literature analysed and is accomplished through the development of employment, qualifications, skills and learning frameworks.

For fulfilment of the first partial goal with the reference to the methodology, authors approach to the survey according to the following key competencies for Industry 4.0. The key competencies for Industry 4.0 are digital competencies, innovation, creativity, cooperation and teamwork, communication skills, problem solving, decision making, lifelong learning and leadership.

The competencies in mentioned articles were used as we use them in this article. As can be seen from Tab. 1 – The literature review of the key competencies for Industry 4.0, many authors research in their studies the key competencies for Industry 4.0.

For fulfilment of the second partial goal with the reference to the methodology, no articles mentioned above don't offer similar research as here in this article. Especially these papers with the largest representation of the key competencies for Industry 4.0 don't offer similar statistical analysis (Hecklau, 2016; Grzelczak, Kosacka & Werner-Lewandowska, 2017; Vrchota et al., 2019; Gudanowska, Prieto & Törmänen, 2018). These authors did the statistic research, but it was focused on the specific area that is different from ours.

A similar survey focused on both the literature review and the statistical analysis of the key competencies for Industry 4.0, which is based on the self-evaluation of respondents, has not been anywhere realized till now.

## 6 CONCLUSION

The challenge of implementing Industry 4.0 is to qualify employees to shift their capacities to workspaces with more complex processes and ensure the retention of jobs in changing working environments. Human capital is one of the areas that organizations are actively involved in and will continue to cope with in the future.

The authors of the article chose the key competencies for Industry 4.0 based on the literature review. The key competencies for Industry 4.0 are digital competencies, innovation, creativity, cooperation and teamwork, communication skills, problem solving, decision making, lifelong learning and leadership.

The authors, who deal with the key competencies in comparison with the term Industry 4.0, outline a similar type of graphical representation of the literary review. The authors of this article were inspired by this type of the graphic representation and used it as the introductory overview for subsequent statistical processing, which is based on the questionnaire survey of the respondents (the managers and the employees).

The statistical survey revealed that respondents, respectively the managers and the employees who use modern technologies for Industry 4.0 have the highest level of self-evaluation in mastering the competency cooperation and teamwork, the average is 8,17 from the 10point scale. On the other hand, the lowest level of self-evaluation of the competency leadership was found, the average is only 6.65 from the 10point scale. This means that experts have the least confidence in mastering the competency leadership.

For fulfilment of the objective of this article, there were set the hypothesis for the specific characteristics. The Kruskal-Wallis Test was used to identify the differences in the self-evaluation of the level of key competencies for Industry 4.0, according to the characteristics that have been selected by the authors: the years in the given job position of the respondents and the size of the organization.

For fulfilment the second hypothesis and the third hypothesis, H<sub>0</sub> was confirmed: assessment level of the selected key competencies does not differ for self-evaluation of the level of key competencies for Industry 4.0.

The results show that in the case of the first hypothesis, the H<sub>0</sub> hypothesis was not confirmed for the type of the job position in the organization for leadership competency. The leadership competency is statistically significant. According to the Mann-Whitney U Test, the administrative staff self-evaluated the level of the leadership competency worse than other categories of staff (top management, middle management and specialists). A milder dependence of the observed character can also be observed in the case of the digital competency. In this case, the administrative staff consider this competency to be less developed than specialists.

This article is the contribution to the study more integrated researches of key competencies for Industry 4.0, but it is evident that more work needs to be done in this important current research area.

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# CONSUMER BEHAVIOUR WHILE WATCHING AN ADVERTISING SPOT

*Tamás Darázs, Ľuboš Jurečka*

## **Abstract**

Modern technologies have influenced marketing research, which can detect information about market and consumers from completely new sources and in completely new ways based on identifying hidden consumer reactions. The application of such methods means that there is accessible information about consumer opinions for decision-making process of business entities in a way that they really are and not as consumer can or wants to present them. In the presented thesis we approach the issues of neuromarketing science, consumer behaviour, as well as the possibilities of analysis of commercials through these methods of behavioural research. Implicit information is obtained by tracking points of interest when consumers look at an advertising spot as well as by tracking points of interest. Implicit methods of consumer research are supplemented by explicit research through a questionnaire. The aim of the research is to demonstrate the use of neuromarketing research for evaluating advertising spot for Volkswagen Company. The research points to the possibilities of exploring the conscious but also subconscious reaction of consumers while watching an advertising spot, which could help to improve the company's marketing communication. The main benefit of the thesis is to obtain information about the unconscious perception of the advertising spot, as well as to reveal the differences between demand and neuromarketing methods of determining consumer behaviour. Through research, we have been able to show that there are differences in the conscious and subconscious perception of the consumer. The technology also allowed us to effectively determine the perception of details in the overall picture that consumers watched, not only comprehensively, but for each participant separately, providing additional options based on consumer segmentation by age or gender or other characteristics.

*Keywords: Marketing communication, Neuromarketing, Monitoring, Reactions, Advertisement*

## **1 INTRODUCTION**

In marketing, from the very beginning of its existence, it is necessary to understand the needs of the end consumer and the emotions that lead him to decisions. Traders, scientists and marketers are constantly looking for new ways to understand and address consumers, and to adapt the usual techniques of addressing the consumer, and to create a new need or higher demand. There are different approaches and ways to achieve this. Needless to say, at a time when the consumer is exposed to a huge supply on the market, offers that bring more emotional than rational benefits or added value often win. Maybe that's why most car factories today outperform themselves in which products bring more driving pleasure than in which vehicle is better or more economical. But what exactly are those emotions? Emotions are a complex feeling, impression or other change of mental character.

In scientific circles, the perception of emotion as a process model of individual components is generally accepted, where emotion is characterized as a short, independent but synchronized change of state in most, preferably in all, of the five subsystems of the organism in response to stimuli, whether from external or internal environment which are essential for this organism, which is also confirmed by Ramirez (2012).

As processes are perceived biologically driven changes over time. Emotions may appear as conscious and actively perceived feelings, but the opposite is true. These are complicated neurochemical internal stimuli - psychological responses to stimuli. Individuals can be driven away from danger or to reward. They are constantly formed in the limbic system, which is a cluster of nerve structures that lie beneath the cerebral cortex and in Homo sapiens are closely linked to recently developed cortical areas. Emotions are consciously felt phenomena and are greatly influenced by our thoughts. Each emotion is created in the human brain by a different network of brain structures, including the hypothalamus and the pituitary gland, which direct hormones that produce physical interactions, such as increased heart rate and muscle contractions (Ramirez, 2012).

## **2 THEORETICAL BACKGROUND**

It follows from the above that the emotions that can influence our shopping behaviour result from the changes that take place in our central nervous system as a result of the senses that are perceived through specialized cells. Therefore, in order to understand how our shopping behaviour will change with certain stimuli, we need to find out how the brain processes these stimuli. The brain is responsible for all of our consumer decisions. For its proper functioning requires a lot of energy. Even though it makes up only 2% of our body's mass, it burns almost 20% of our energy. Most of our daily lives are controlled by the brain without our consciousness. It is known that we consciously use only about 20% of our brain. We don't control most of our attention because we are too busy scanning the environment for potential threats. Because nothing matters, just survival, we are, in fact, largely controlled by the oldest part of our brain. Research confirms that the evolutionarily oldest parts of our brain have evolved over millions of years. They are preverbal; these parts of the brain do not understand complex messages and try to avoid pain or excitement. It is the part of the brain that makes us extremely selfish and drives our strong preference for mental abbreviations over long considerations. The strongest aspect of the work of "prime brain" is the fact that it is able to process visual stimuli without involving those mental attributes that characterize the complexity of the human mind. Therefore, we prefer pictures to words and experiences to explanations. (Glimcher et al., 2009)

If we call the usual methods of marketing research and consumer behaviour superficial today, we are telling the truth, because they are most often based on observation of explicit data, but in the spirit of analysis there is a need to understand consumer behaviour from the essence of every decision. Until a few years ago, what was happening in the human brain was a great mystery, and traders could only rely on their experience. Exact methods of consumer detection were based on knowledge from psychology or psychographics (Světlik, 2012)

Lee, Broderick and Chamberlain (2007) have previously argued that current technological advances allow for new approaches and methods leading to brain research. There are extensive opportunities to adapt to current trends, one of which is to abandon frequently used procedures and methods and to target marketing research to understand the needs and values of the target group. Mass marketing is in decline today and organizations are struggling concentrate their activities on a certain market segment. For the target group, modern marketing methods and practices are used, which are used to research new ways for effective marketing. Due to the need to understand the consumer, it is necessary to find complex ways of understanding his conscious and unconscious motives, which are

By analogy of the glacier, we can see the difference between traditional and innovative marketing research. While traditional methods can only work with conscious aspects of

behaviour, modern research methods, such as neuromarketing, also deal with unconscious processes in human behaviour (Rampsoy, 2014).

Neuromarketing is a combination of two areas. And that's neuroscience and marketing itself. This creates room for progress in knowing how and according to which consumers make decisions and how marketers can benefit from it (Nagyová et al., 2014).

It is expected that there is great potential in this discipline to elucidate the implicit and automated processes that determine the decision-making process, that they are exposed by hidden information about decisions that allow traditional marketing methods to be disclosed (Tusche, Bode & Haynes, 2010).

Our study is not the first to try to obtain implicit information through neuromarketing. Giroladini (2020) used EEG to analyse the video clip. He found that the application in the field of neuromarketing appears to be simple and effective and allows to evaluate the subject's reaction with a time resolution of about 1 second.

In our research, we used methods of recording facial expressions. Our previous experiments have already indicated the functionality of these methods in terms of obtaining the information provided. Research by Höfling et al. (2020) also shows that however, it provides a promising new measurement method for non-contact assessment of emotional responses.

### 3 METHODOLOGY

The aim of the research is to use neuromarketing research to evaluate Volkswagen's advertising spot and to point out its advantages and possibilities of examining the conscious but also subconscious reactions of participants. The main benefit of the thesis is to obtain information about the unconscious perception of the commercial, as well as to reveal the differences between demand and neuromarketing methods of determining consumer behaviour, but especially to point out the possibilities that these techniques bring.

#### Methods used to obtain data

**Fixed EyeTracker:** The first results of neuromarketing research were provided by the EyeTracker program. We used a fixed type of device from Gazepoint. We created simulated conditions, attached the device to a 22-inch LED monitor and set the correct position. EyeTracker technology is based on the reflection of light from the retina back to the camera; it is a binocular system that has a sampling frequency of 60 Hz. The tolerance to the subject's head movements of 25 cm x 11 cm ( $\pm 15$  cm) was set to a deep movement with an accuracy of 0.5-1 degree of visual angle.

**HD camera:** A compatible device for this type of output was a camera from Microsoft - LifeCam Studio with a 1080p HD sensor, whose task was to record the faces of participants.

**Questionnaire:** The last, additional method was to collect data from participants who participated in neuromarketing research.

#### Methods used for data processing

**Gazepoint Analysis 3.0:** Software for processing data recorded with an eye camera. In Gazepoint Analysis 3.0, we were able to analyze the results of heat maps, fixation dots, clusters and opacity maps.

**FaceReader:** Software for reading facial expressions. The second program that provided us with the results of neuromarketing research was the program FaceReader 6.1. A device from Noldus that can detect six basic emotions, i.e. joy, sadness, anger, surprise, fear and resentment

and a neutral state of facial micro mimics. Another important function of this device is the ability to examine whether the subject has open eyes, mouth, in what position his eyebrows are (raised or not) and can also identify whether the participant is wearing glasses. The advantage of the FaceReader program is the fact that all data obtained by the program can be imported into any statistical software. The analysis of facial expressions using this device was validated by comparison with the manual scoring of individual expressions. The significance level for FaceReader 6.1 is 95%.

**Mathematical and statistical processing:** This method was used to process the data that resulted from the answers of the respondents in the submitted questionnaire after watching the advertising spot.

### **Methods used to display data**

**Points of interest, bee swarm:** We selected the key moments of the video, which we recorded as images, and analysed the reactions and behaviour of the respondents on the individual types of outputs of GazePoint Analysis 3.0. We identified points of interest in places in the video that we considered important, and we wanted to know what attention the respondents paid to them while watching. Bee swarm is a method on the basis of which we were able to find out where the respondents' sight was directed at a given key moment of the commercial.

**Valencia, interest:** Another method based on the FaceReader program was data processing based on participant engagement and valence of emotions. The software used a camera to record the facial expressions and facial expressions of the participants. We had the opportunity to see at which key moments the interest of followers will increase and when their mood will change.

**Graphs and tables:** For the purposes of evaluating the questionnaire survey, we prepared graphs and tables in which we processed the answers and classification of respondents according to classification questions.

### **The course of neuromarketing research**

The neuromarketing research was carried out in the following steps: (1) Acquaint the participants with the method of research; (2) Setting the correct distance between the camera and the participant; (3) Calibration of the EyeTracker program; (4) Launch of an advertising spot; (5) Data processing by EyeTracker and FaceReader programs; (6) Filling in the questionnaire by the respondent; and (7) Consent of the respondent to data processing.

For our neuromarketing research, we chose an advertising spot called Volkswagen Tiguan advertisement: Laughing Horses. The idea of this spot is the possibility of using a parking assistant to park immediately and without problems. However, the main role in the video is played by laughing horses.

Campaign: Laughing Horses (Volkswagen, 2016)

Product: Volkswagen Tiguan with Trailer Assist

Production: Czar advertising agency

Advertising agency: Grabarz & Partner Werbeagentur GmbH

Location: Volkswagen Netherlands

Creation date: May 2016

We chose this commercial because we consider this to be the most comprehensive of all Volkswagen's known video commercials. The video fascinates the viewer right at the beginning, and the engaging way of advertising keeps him in suspense until the last moment,

what the video is all about. Laughing horses give the video a fun theme, so it's a non-violent form of promoting the Tiguan car, as people like to see something that puts a smile on their faces. An important factor in the selection was certainly the placement of another brand of car in this video. We had the opportunity to find out if the participants will be interested in things outside the main storyline of the video.

## 4 RESULTS

The neuromarketing research with the help of EyeTracker was carried out on March 30, 2017. The aim was to recognize and record, in addition to the conscious and subconscious reactions of the participants when watching the Volkswagen commercial. Research was attended by 21 participants, of which thirteen were women and eight men. We divided the commercial into key moments in individual segments, see. Figure 1.



Fig. 1 – Marking points of interest in Gazepoint Analysis software. Source: own research

At 00:07, the first car will appear in the commercial. In the EyeTracker record, we marked two points of interest - the brand of the car and the horse. AOI 8 is the designation for the location of the brand of the first car, and behind the square of AOI 9 are the horses that are the reason why this commercial is called Laughing Horses.

Figure 2 shows the behaviour of participants while watching a commercial. Out of 21 participants, 19 people focused their attention on horses, while only 4 participants focused on the car brand. Also, the viewers' sight was longer focused on the horse in the video, and they returned to them more often with their gaze. The reason for such a result may be that in these moments you can still hear the laughter of the horses, and so the observer and the eyes still concentrate on the horses behind the fence.



Fig. 2 – Points of interest - EyeTracker export. Source: own research

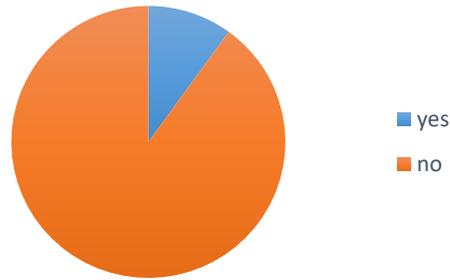


Fig. 3 – Have you seen the brand of the first car? Source: own research

The two of the 21 participants, i.e. 9.52%, thought they had seen the brand of the first car. In reality, however, there was no brand on this car, as it was an advertisement for Volkswagen, which did not want to place the brand of another car directly in its advertisement. The results of the second question from the questionnaire test "If you noticed what brand the first car was, please write it down", they show how we can be wrong with the feeling of conscious action. The first respondent mentioned the Volkswagen brand and the second the Suzuki brand. None of the answers were correct. The first car to appear in the video was the Toyota brand.

As another key moment for the analysis of the advertising spot by neuromarketing methods, we chose laughing horses in the 21st second of the video, see Figure 4, specifically a horse rolling from laughter on the ground. Each dot belongs to a different participant, so we can see that the views of the participants in this part of the video are directed to the horse lying on its back. We consider this moment of the video to be the funniest, so we are not surprised by the behaviour of the participants who, in the key scene of the video, paid their attention to the laughing horse on the ground.

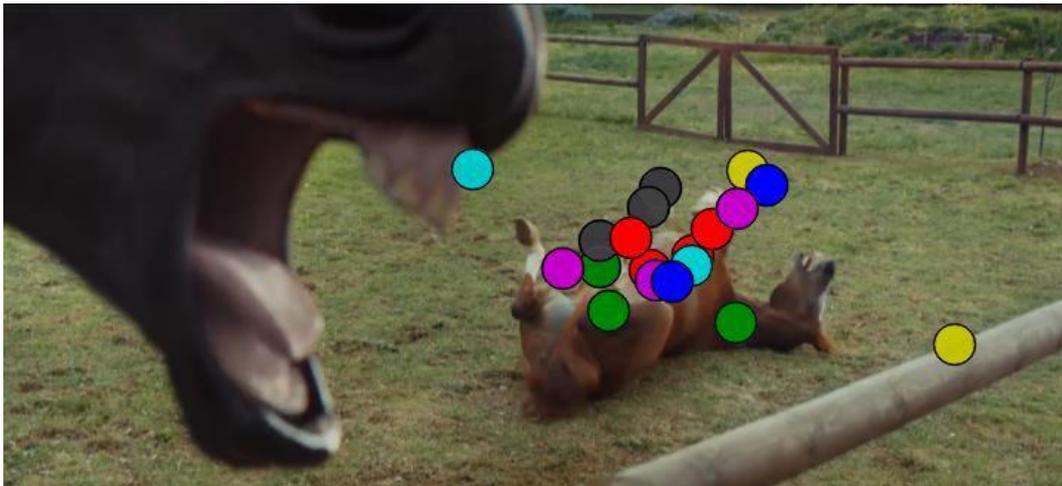


Fig. 4 – Bee Swarm - output from EyeTracker laughing horses. Source: own research

In Figure 5 we can see the points where the participants' sight was directed in the part of the video where the Volkswagen car appeared - the Tiguan model. Most of the participants paid their attention to the Volkswagen car. This is confirmed by Figure 6. In this position, the car has been on the screen for a long time, so the participants had more time to look at this car in detail. The laughter of the horses also subsided, so nothing disturbed the participants.



Fig. 5 – Bee Swarm - output from EyeTracker arrival of Volkswagen car. Source: own research



Fig. 6 – Output from EyeTracker - arrival of Volkswagen car. Source: own research

While the brand of the first car was subconsciously perceived by four participants, in the case of the Volkswagen, the Tiguan model, this number had risen to 10 participants; it could be due to a deliberately attractive image of the car. At this point in the video, we've noticed a difference in gender interest, which we'll see in Figures 7 and 8 below.



Fig. 7 – Output from EyeTracker - arrival of Volkswagen car, view of a woman. Source: own research



Fig. 8 – Output from EyeTracker - arrival of Volkswagen car, view of a man. Source: own research

On the other hand, only two out of eight men were interested in the brand of the second car. They focused more on the overall look of the car and its hood. The reason may be the fact that men are focused on the technical side of cars, and thus did not show interest in the brand, or already knew it based on the appearance of the car.

The last moment analysed in the advertising spot using EyeTracker was the moment of displaying the logo of the advertising company, see Figure 9.



Fig. 9 – Output from EyeTracker - Volkswagen logo. Source: own research

It is clear from Figure 9 that the participants preferred the graphic representation of the Volkswagen logo over the inscription. In this part, the view of all 8 men - participants was directed to the logo and of the thirteen women who watched the video, only 3 paid more attention to the inscription. The Volkswagen brand is one of the most well-known brands on a global scale, so the logo can be a sufficient sign for participants to know who is behind this fun video.

### **Advertising spot analysis using FaceReader technology**

In addition to EyeTracker technology, we also used a program in our neuromarketing research that detected and analysed the facial expressions and facial expressions of participants when watching a commercial. Also, in this stage of the research, the aim was to identify and process the reactions of the participants. In the FaceReader program, we analysed all 21 participants who participated in the research.

Figure 10 shows how FaceReader records participants' responses. The camera captures and captures the key points of the face, which with their movement signal certain reactions and emotions of the participant. The program then processes and analyses these suggestions and provides us with useful information, see Figure 11.

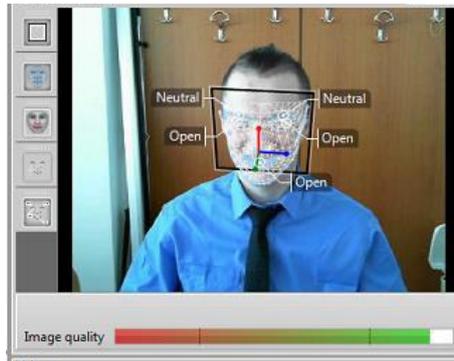


Fig. 10 – Example of FaceReader - detection of a participant's face. Source: own research

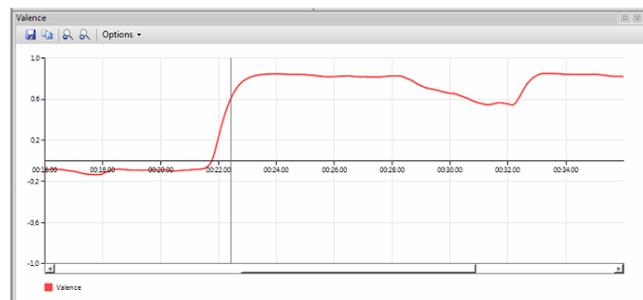
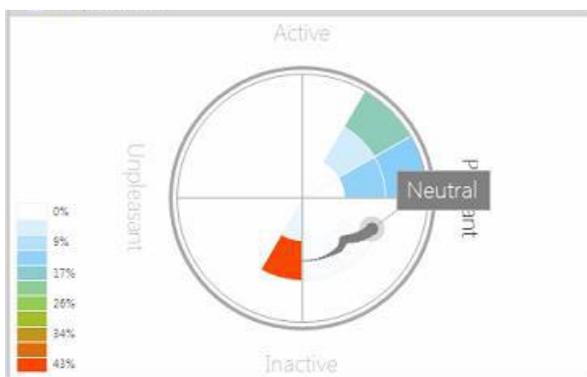


Fig. 11 – Valencia Mood Man, 25 years, 21st second of the video. Source: own research

From the options of the FaceReader software, we chose an analysis of the valence of participants' moods, see. Figure 11. This is a graphical representation of the processed data while the participant is watching the commercial. When interpreting the results from EyeTracker, we discussed in detail the moment of the 21st second, when a horse appears in the video, laughing on the ground. And it was this moment that became an important factor in examining the moods and emotions of the participants. The horizontal X-axis, at the zero boundary, represents neutral emotions. Each deviation downwards represents a facial expression that corresponds to negative manifestations, and each deviation on the X-axis upwards represents positive reactions. And just in the 21st second of the video, most participants began to respond positively to the commercial, i.e. laugh and show positive reactions.



- Upper left quadrant = active observation and discomfort
- Lower left quadrant = passive observation and discomfort
- Lower right quadrant = passive observation and a pleasant feeling
- Upper right quadrant = active observation and a pleasant feeling

Fig. 12 – Quadrants of interest and mood of man, 25 years. Source: own research

The picture from the number 23 shows the course of interest and moods of the participant - a 25-year-old man, in the mentioned 21st second of the video. We can thus see that at this moment of the video, watching the participant goes from impartiality and discomfort, through a neutral feeling, further to active watching and a pleasant feeling. We also addressed this key moment

in Figure 13. This is the part of the commercial where a laughing horse on the ground appears in the video participants begin to respond with a smile and laughter, showing interest and giving the video more attention.

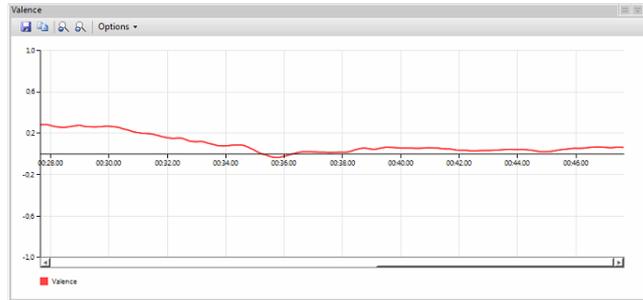


Fig. 13 – Valencia Mood Woman, 62 years, 21st end of the video. Source: own research

The course of the end of the video and the mood of the participants can be seen in Figure 13. While at the beginning of the video the mood of 15 of the 21 participants was below the X-axis level, at the end of the video the mood of 17 of the 21 participants remained above the X-axis level. This is a significant difference, which manifested itself thanks to the commercial.

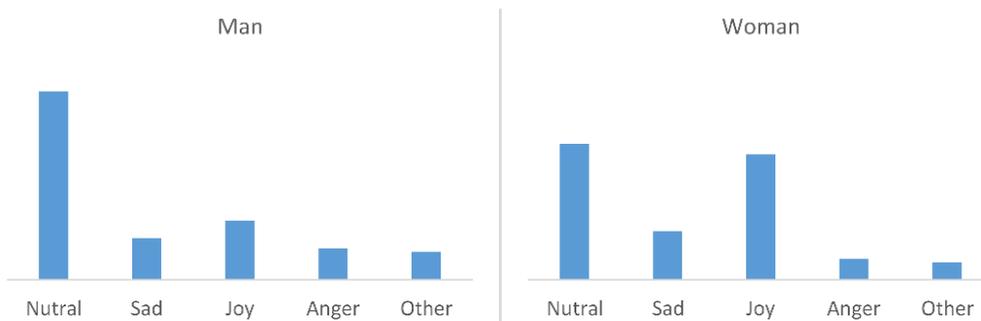


Fig. 14 – The overall mood. Source: own research

As we can see in Figure 14, more than half of the men, i.e. 54% on average, during the entire period of watching the commercial, showed reactions corresponding to a neutral rating. The remaining less than half of the moods were almost evenly grouped in the order of 17% joy, 11% sadness, 9% anger and 9% others. Other manifestations included boredom, resentment, and surprise. While watching the video, the women showed emotions, facial expressions and facial reactions at a level that corresponded in a balanced way to neutral feelings and joy. 39% of women perceived this commercial at the level of "neutral", 36% of women perceived it with a feeling of joy and laughter, 14% expressed emotions expressing sadness, 6% anger and 5% other expressions.

Respondents who participated in the research by watching the video had to express their thoughts and feelings in the form of a questionnaire after looking up. Some questions were conceived by a simple graphic representation.

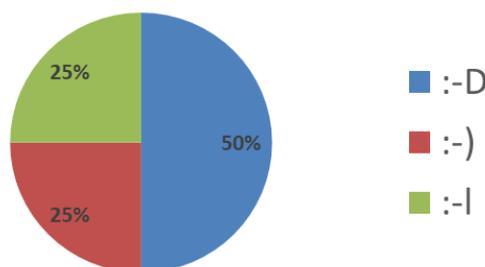


Fig. 15 – Video rating - man. Source: own research

The most positive emoticon was rated by an advertising spot by 4 men, i.e. 50% of male respondents, the second and third emoticon in the order of satisfaction received two answers. The other two emoticons that expressed negative feelings were not marked by a single man.

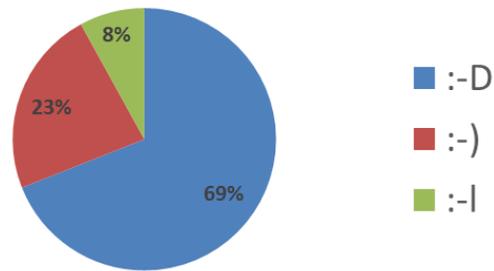


Fig. 16 – Video rating - woman. Source: own research

The first emoticon had the largest representation in the evaluation from women. That is, the one who expressed the greatest joy and satisfaction with the advertising spot. 9 out of 13 women marked it. The second emoticon in the order received 3 votes and the third emoticon received 1 vote. As in the case of male respondents, neither women rated the commercial with one of the last two emoticons on the satisfaction scale.

### Classification of respondents

In Table 1 we can see the age structure of the respondents. The biggest group consists of people from 18 to 25 years, followed by a group aged 26-35 years, 2 respondents belonged to the age range of 46-60 years, two were also from the group of 61 and more years, but one respondent was from 36 to 45 years.

Tab. 1 – Structure of the respondents. Source: own research

	Absolute abundance	Relative abundance	Relative abundance in %
<b>Gender</b>			
Women	13	13/21	61,9
Men	8	8/21	38,1
<b>Age</b>			
18-25	12	12/21	57,16
26-35	4	4/21	19,05
36-45	1	1/21	4,77
46-60	2	2/21	9,51
61 and more	2	2/21	9,51

## 5 DISCUSSION

21 participants, 13 women and 8 men, took part in the neuromarketing testing together with a questionnaire survey. When we summarize all the results we analysed, the Laughing Horses commercial was more interesting for women. Up to 9 of 13, i.e. 69% of the participants consciously rated this video the most positively and thus expressed maximum satisfaction with the video. In the case of men, the video received the best rating for only 4 participants, which represents 50%.

We also found that women were more interested in watching the video. They followed most of the details in the advertising spot and also tried to remember what brand the first car was. While the men did not answer this question in the questionnaire at all, they confirmed the result of FaceReader that their elements in the video were less interesting. Since the purpose of this

commercial was to increase brand awareness and attract viewers in a humorous way, we can evaluate the video positively. 71.43% of participants expressed emotions before or shortly after the video was launched, which the system assessed as neutral to negative. At the end of the video, this number dropped to 19.04%, so only a small proportion of participants showed no mood swings. The responses to the questionnaire survey confirmed these results. The video Laughing Horses impressed the emotions of the watchers and they felt in a better mood after watching the video.

## 6 CONCLUSION

However, the aim of this thesis was not to evaluate Volkswagen's advertising video, but to point out, through the analysis of the advertising spot, the possibilities of examining the conscious but also subconscious reactions of the participants.

Through EyeTracker technology, we have been able to demonstrate once again that there are differences in the conscious and subconscious perception of the consumer. This technology has also allowed us to effectively determine the perception of details in the overall image that consumers have observed, not only comprehensively, but for each participant separately, providing additional options based on consumer segmentation by age or gender or other characteristics. Also, the FaceReader method offers options based on analysing efficiency according to various characteristics, as well as the overall average value, because the data can also be processed statistically, for example in Microsoft Excel. However, unlike the previous method, it offers the opportunity to find out not where one looks, but how one feels. The research proved the possibility of a detailed, statistically relevant depiction of the moods of individual respondents resp. average values for all participants, for the entire period of watching the commercial or its section. However, it should be noted that the results often show not only the expected moods, but also others that are not desirable at the moment, this may be due to the fact that participants were not in the experiment in a natural environment in which they feel comfortable, they could also concentrate on the experiment itself, and so in the overall results the program negligibly evaluated feelings as fear or sadness. However, the statistical significance of these feelings compared to joy is low. Importantly, in a detailed analysis of the respondents' moods, it is possible to see how all these "undesirable" moods disappear in the 21st second of the video, and this proves the effectiveness of the examined method. Thus, the method is functional in this type of application, offers a number of possibilities, and when used correctly can be an effective way to create communication that results in positive associations.

Based on the questionnaire survey, we can state that the participants saw their opinion in conflict with how it was evaluated by previous methods of data collection. The reason may be that people as they often have trouble expressing how they feel and what they think.

As we have already mentioned, this thesis was not conceived as a work analysing a commercial, but a thesis that should confirm the functionality of methods of obtaining consumer data in innovative ways that can analytically bring accurate data from every second of consumer perception. For this reason, it is not the relevance of the characteristics of the sample of participants that is relevant, but its frequency. The number of participants in this work exceeded the number by one volunteer, in which experts agree that it guarantees relevant, statistically significant results. However, this fact offers opportunities for further research, focusing, for example, on the effectiveness of individual methods in samples with different characteristics.

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# CHINA-EU FOREIGN TRADE RELATIONS AND THEIR PERSPECTIVES ON THE BASIS OF THE BELT AND ROAD INITIATIVE

*Barbora Družbacká*

## **Abstract**

In recent years, trade between China and the European Union (EU) has increased dramatically. This paper draws on trade data to examine the development of China-EU foreign trade in their biggest trading partner - EU. More specifically, it examines the evolution of the trade in goods of China's-EU trade between 2009 and 2019 and the current territorial structure of mutual trade. On this basis, the five largest trading partners from a given integration grouping were profiled, in which the trade intensity was examined to determine whether the value of trade between these countries was higher or lower than would be expected based on their position in the world trade. The results show that the trade intensity between the world's two largest traders is not as high as would be expected on the basis of their position in world trade. However, during the period under review, China launched the Belt and Road Initiative that is beginning to take on real contours and may increase the already enormous exchange of goods across the Eurasian continent. The article also points to the most significant China cooperation in the initiative with the most important EU economies such as Germany, the Netherlands, and Italy.

*Keywords: Belt and Road, China, EU, Foreign trade development, Trade intensity*

## **1 INTRODUCTION**

The process of globalization is now commonly used to explain various economic and trade trends that are literally shrinking the world through improved technological sophistication, transport, and communications. The development of world trade has undergone significant quantitative changes in the 21st century, the intensity of which is constantly increasing. As in this period, it created a new triad of economic power – the United States, EU, China, as a result of globalization tendencies, and related social, economic, and geopolitical changes (Družbacká & Krivosudská, 2019). While the protectionist tendencies of President Trump's administration are slowing trade flows between China and the United States, the implementation of initiatives and projects such as the Belt and Road Initiative (BRI), which is taking shape, is expanding trade cooperation opportunities across the Eurasian continent.

Two of the world's most prominent powers, the EU and China, established formal diplomatic relations in 1975 and signed a comprehensive strategic partnership agreement in 2003. Slowly but steadily they have built a partnership, which embodies probably one of the most structured relationships between two major powers in today's world arena. Its significance lies not only in connecting two key order-shapers in today's world, but also in the management of the antagonistic quality of the relationship between actors with such different identities (Geeraerts, 2019). In 2013, both sides are committed to a comprehensive strategic partnership, as expressed in the EU-China 2020 Strategic Agenda for Cooperation. However, there is a growing appreciation in Europe that the balance of challenges and opportunities presented by China has shifted. In the last decade, China's economic power and political influence have grown with unprecedented scale and speed, reflecting its ambitions to become a leading global power (European Commission, 2019). This paper also demonstrates China's growing strength, especially in the area of international trade, as it maps its development with the largest trading

partner - the EU, as well as trade with the five largest trading partners among member countries. Further focusing on the current trade intensity. These results are confronted with an ever-evolving BRI.

## **2 LITERATURE REVIEW**

According to Baláž et al. (2019), international trade, the most important part of external economic relations, is an indicator that signals the real level of and the real state of the world economy and its individual territorial components. It is especially important between two such important traders as China and the EU. The position of the EU in the world economy and its foreign trade is discussed in more detail by Kittová (2020). Similarly, Kašťáková, Drieniková and Zubařová (2019) researched impact of the geopolitical changes on the EU foreign trade relations.

The degree of upgrading of China's trade structure with the world as a whole and in particular with the European Union was examined by Li, Dunford and Yeung (2012). Baláž, Zábajník and Harváněk (2018) stated that the long-term development of mutual economic relations between China and the EU was also affected by many systemic changes (EU enlargement or Chinese expansion) that took place in the process of globalisation. The importance of mutual trade lies in particular, the EU can play an important role in driving China's long-term objective of becoming a higher value-added producer by supplying technology and business services to Chinese firms. At the same time, the EU is likely to remain a source of high-end goods and services for an increasingly demanding (and affluent) Chinese consumer class (Hansakul, Levinger & Lanzeni, 2014). Karkanis (2015) examined trade flows between China and the EU who considered the geographical locations of the EU countries. Baláž, Královičová and Steinhauser (2020) claimed that it will be crucial for the future of the EU to find a way to cooperate effectively with China so that it is a mutually beneficial cooperation, which will bring prosperity to both trade partners.

Likewise, the cooperation of these two countries within the BRI is examined from different perspectives. For example, Liu et. al (2019) examined the impact of the New Silk Road route across the North Sea on Sino-European trade potential. Li, Bolton, and Westphal (2018) analysed the impact of the New Silk Road railways on total trade between China and Europe. The authors dealt with the influence of the intercontinental railways, which belong to the New Silk Road within the BRI, on trade between China and its trading partners in Central Asia and Europe. On the other hand, Yiwei (2015) examined EU-China relations with regard to the realization of the new Silk Road, pointing to several opportunities for the EU such as: opportunity to transform and upgrade the China- EU comprehensive strategic partnership, opportunity for the EU to participate more easily in Asia-Pacific Affairs, opportunity to build a greater Eurasian market. But Minghao (2016) finds several challenges that countries face in cooperating on this expansive initiative. The most important include trust deficit between China and Europe, many obstacles in the fields of norms, mechanisms and laws affecting China-Europe cooperation, or concern that China may use the BRI to play the 'divide and rule' game in Europe thereby aggravating internal disunity in Europe.

## **3 METHODOLOGY**

The article focuses on the evaluation of foreign trade between China and the EU and the prospects of their cooperation in the context of the implementation of the initiative known as Belt and Road. To achieve the principal aim, we set sub-aims: (a) assessment of the development of China-EU foreign trade relations over the last decade, (b) review of the current (2019) territorial structure of China's and the EU's foreign trade, (c) calculation of the index of

trade intensity between the given partners, and (d) assessment of the potential for the implementation of the BRI in the context of foreign trade relations between China and the EU, with an emphasis on the largest trading partners.

The article used basic scientific research methods such as analysis, synthesis, induction, deduction, or selection of selected data. By a literature retrieval we searched and collected relevant information concerning the given issue. Data provided by the International Trade Center were used for the results of foreign trade, which provides reporting of foreign trade in a specified time interval within the ITC Trade. For a better view and interpretation were reflected in the graphical display. The same data were used to quantify the index.

A one-factor indicator of foreign trade evaluation was used to calculate the trade potential between the given trading partners.

The Trade Intensity Index (TII) is used to determine whether the value of trade between two countries is greater or smaller than would be expected on the basis of their importance in world trade. It is defined as the share of one country's exports going to a partner divided by the share of world exports going to the partner (World Bank, 2010). It is calculated as:

$$TII = \frac{(x_{ij}/X_{it})}{(x_{wj}/X_{wt})} \quad (1)$$

Where  $x_{ij}$  represents the value of the first country's exports to the second country,  $x_{wj}$  represents the value of the first country's total exports to the whole world,  $X_{it}$  represents the value of world exports to the second country and  $X_{wt}$  is the total value of world exports.

TII reaches values from 0 to  $+\infty$ . If the value of the index is equal to 1, it means that the exporting country  $i$  exports to the country  $j$  the exact ratio of exports that the country  $j$  belongs to with regard to its share in world imports. If the index is higher than 1, these are trade flows in higher values than might be expected given the importance of the country in the world economy, ie. country  $i$  exports to country  $j$  in proportion to more goods than to the whole world. If the value is less than 1, then the intensity of trade is also at a lower level than might be expected (World Bank, 2013). Due to the problem of transparency of data related to BRI, the relevant press releases and statements are also used in the article.

## 4 RESULTS

The EU, as an integration grouping, is the world's largest trading power, as well as the world's largest exporter of goods, with a value of over 6.3 trillion \$ in 2019. However, China's boom due to seizing the rapid development opportunity of economic regime reform as a process of globalization has secured China (as a separate country) its position as the largest exporter of goods since 2009, with China's exports accounting for about 13.3% of world exports in 2019 in the total value of over 2.4 trillion \$. As a result, China and the EU are the world's largest traders. China is the EU's second largest trading partner after the US. The EU is China's largest trading partner (European Commission, 2020). The enormous amount of goods flowing between the European Union and China represents the value of mutual trade on average more than 1 bill. \$.

Based on the data of Fig. 1, it can be stated that the development of foreign trade relations between China and the EU has been developing negatively for the EU in the last decade. Despite the fact, that the trend of increasing both Chinese exports to the EU and EU imports to China has been growing over the past decade. Within the period under review, China's exports to the EU dominate. China's average value of exports to the EU is 350 bill. \$ each year. The highest value of exports was recorded in 2019, when goods worth 428.1 bill. \$ were exported to EU

countries. The same year also brought China the highest value of the positive trade balance, which amounted to 151.7 bill. \$. Despite the EU's efforts to reduce the negative trade deficit, the EU exports to China an average of 217 bill. \$ goods a year. The lowest difference between Chinese imports and exports was recorded in the observed period in 2009, when it amounted to 109.7 bill. \$.

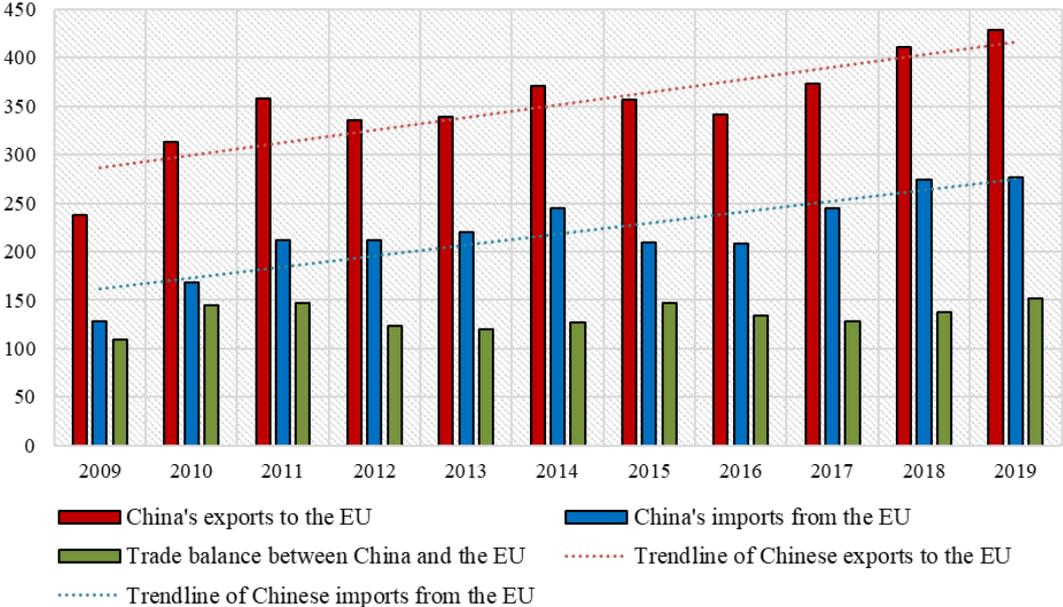


Fig. 1 – China-EU foreign trade between 2009 and 2019 (billion \$). Source: own research based on data from ITC Trade Map

The territorial structure of Chinese exports to EU countries in 2019, shown in Fig. 2, points to the dominant position of Germany as a Chinese export market. In that year, China exported goods worth 79.9 bill. \$ to this country, which represents about 1/5 of exports to the EU. The second largest export market was the Netherlands, where goods worth approximately 73.9 bill. \$ (17.3%) were exported. It is followed by the United Kingdom with imports worth 62 bill. \$ (14.5%), with a significant difference Italy - 33.4 bill. \$ (7.8%) and France - 33.1 bill. \$ (7.7%).

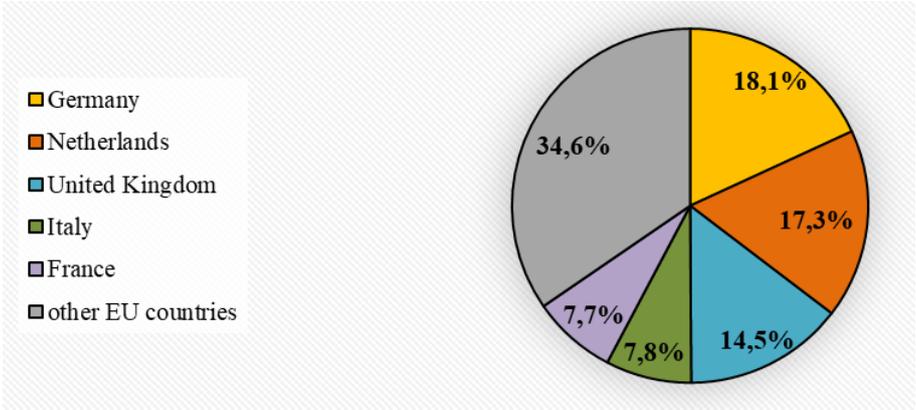


Fig. 2 – Territorial structure of China's exports to the EU in 2019 (%). Source: own research based on data from ITC Trade Map

Of the EU countries, Germany exported the most to China in 2019 (Fig. 3). The value of exported goods amounted to 105 bill. \$, which represents over 1/3 of total exports from the EU to China. The second largest export partner was France, which exported goods worth 32.6 bill. \$ (11.8%). In third place is the United Kingdom - 23.8 bill. \$ (8.6%). The fourth largest exporter

was Italy, which exported goods to China for more than 21.4 bill. \$ (7.7%). These countries are also among China's largest trading partners in the EU. In fifth place with a significantly lower value of exports is Ireland - 13.4 bill. \$ (4.9%). Nevertheless, Ireland has not been one of China's five largest overall trading partners among EU countries in the last decade. It is surpassed by the Netherlands, the sixth largest exporter in 2019 - 11.2 bill. \$ (4%), which is because of China's high exports to this member state.

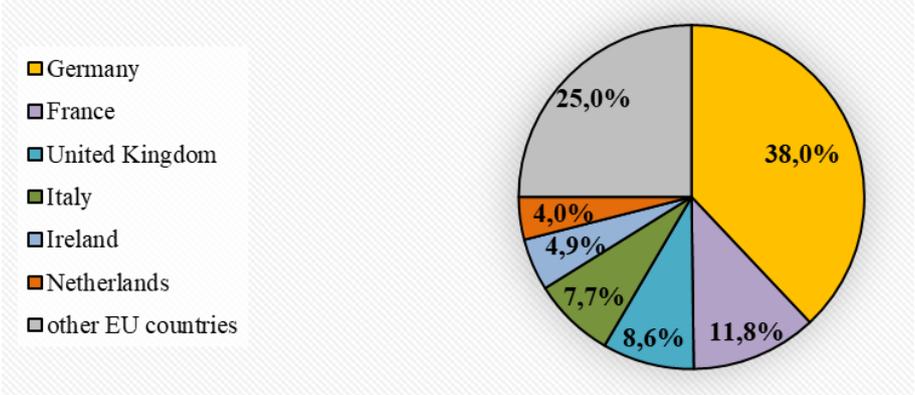


Fig. 3 – Territorial structure of China's imports from the EU in 2019 (%). Source: own research based on data from ITC Trade Map

Fig. 4 illustrates China's five most important trading partners among the EU27 + United Kingdom member states, based on the average value of total trade from 2009 to 2019, including Germany, the United Kingdom, the Netherlands, Italy, and France. Chinese exports to Germany over the last ten years averaged 69.7 bill. \$ with a growing tendency. On the other hand, based on the latest available data, a lot of Chinese imports from Germany averaged 90.5 bill. \$. Thus, China has achieved a negative trade balance with this European country in the last decade. The Netherlands is an important trading partner, especially in the area of Chinese exports, as they imported goods from China with an average value of 60.1 bill. \$, while despite the growing trend, it exports goods worth approximately 9 bill. \$. The total value of trade between the United Kingdom and China has increased significantly over the last ten years. While at the beginning of the period under review it amounted to 39.1 billion \$, in 2019 it reached the value of 81.9 bill. \$. China's total trade with France is worth an average of 52.1 bill. \$ and with Italy 46.1 bill. \$.

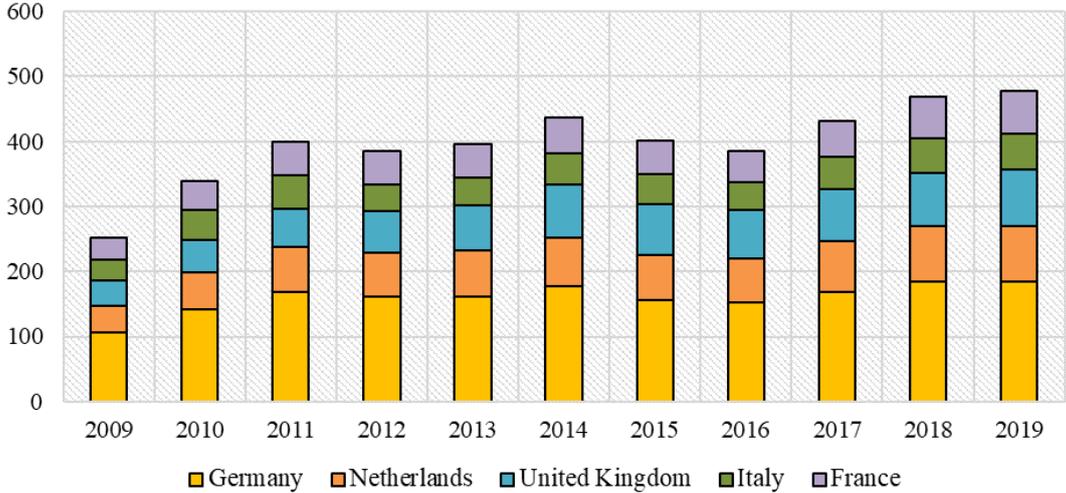


Fig. 4 – Total value of China's foreign trade with the EU's five largest trading partners between 2009 and 2019 (billion \$). Source: own research based on data from ITC Trade Map

## Intensity of China - EU foreign trade relations

In assessing China-EU trade, including the five most important trading partners, we calculated the trade intensity index, which is used to assess whether trade volumes between the two countries are greater or less than would be expected based on their position in the world economy.

Fig. 5 shows the development of TII exports of China to the EU, as well as to its five largest trading partners from among the member countries in the last decade. The intensity of China's trade or exports to the EU is relatively stable at around 0.5, indicating that trade intensity has not changed significantly. Nevertheless, the value of the indices is less than 1, so we can say that trade between the countries studied is less than would be expected.

Despite the fact that Germany is the largest trading partner of China among the EU countries, TII, which recorded the highest value in 2010 (0.61) has a declining trend and in 2019 was 0.48 according to the World Bank methodology, thus pointing to low trade exchanges between the countries examined. The highest values of the index were recorded in the analysis of trade with the Netherlands, where TII was greater than 1 in 2014 during the period under review and thus bilateral trade flow was greater than expected, given the importance of the partner country in the world trade. At present, however, the index is 0.87.

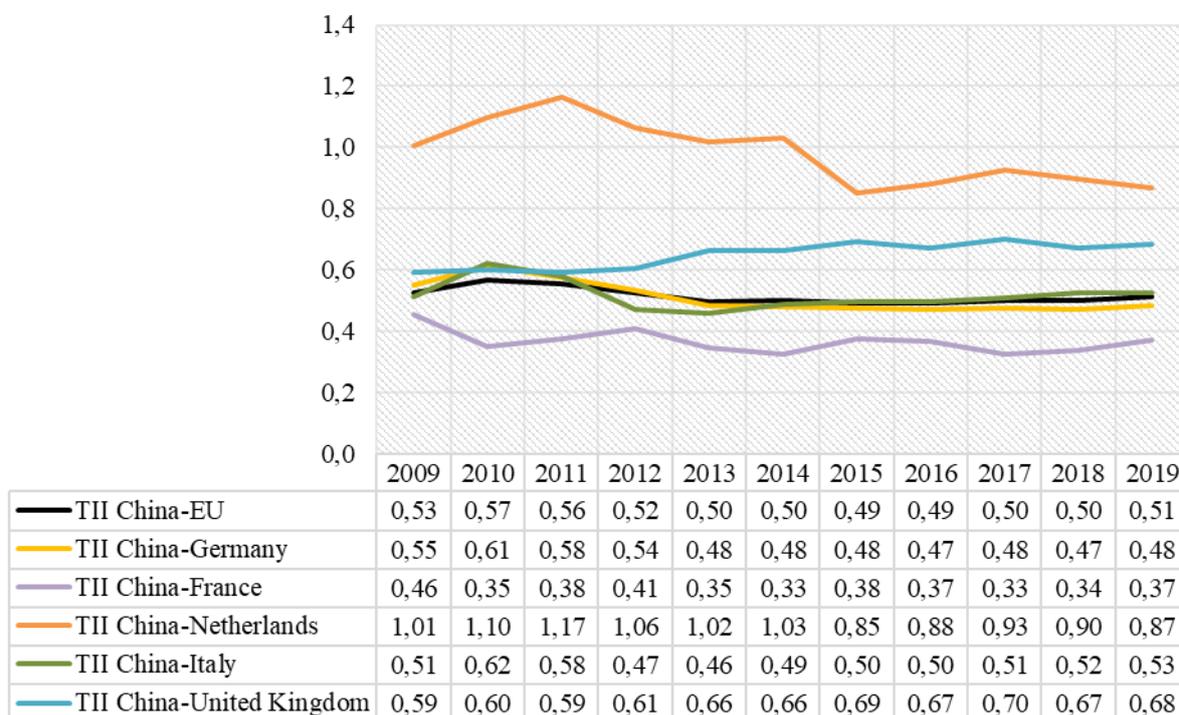


Fig. 5 – Development of TII China - EU and China's five largest trading partners from among EU countries between 2009 and 2019. Source: own research based on data from ITC Trade Map

Similarly, in the remaining partner countries, trade intensity remains relatively low, with only the United Kingdom achieving a more significant increase. But this economy terminated EU membership on 1 February 2020. To compare TII in examining trade between China and its second largest trading partner, the United States averaged 1.36 over the past decade, indicating a stronger trade relationship than the US global average.

## 5 DISCUSSION

Based on the above results of mutual trade between China and the EU, as well as on the implementation of the BRI presented by the Chinese government in 2013, changes in the current development of this trade between the partners can be expected. China and the EU are at opposite ends of the Eurasian continent, yet this land mass is increasingly acting as a bridge rather than a barrier between them (Cornell & Swanström, 2020). One of the principal goals of the BRI is to improve connectivity between Europe and Asia. The BRI can, therefore, be seen as an interconnection between the countries and economies of the Eurasian continent in particular, through a range of projects aimed primarily at supporting the development of infrastructure, and coordination of national and regional development plans. The BRI should thus expand and interconnect transport networks and markets, disperse and improve Eurasia's production capacity, facilitate the transit of goods, capital, energy, raw materials, and, to some extent, information, people, and culture. It plans to do this through substantial investments in road, rail, port and aerial infrastructure, along with ancillary facilities such as power grids, energy pipelines and high-speed fibre optic cables (Ghiasy & Zhou, 2017).

Nowadays, views on the BRI divide the European Union into two groups. On the one hand, Europe's largest economies, such as Germany and France, share similar concerns that key elements of China's trade and industrial policy, such as intellectual property theft, forced technology transfers, lack of investment transparency and lack of market reciprocity, are economic threats to the EU. They also express concern about the inflow of Chinese investment and its alleged consequences in terms of political influence, control of key transport hubs and access to sensitive technologies. Similarly, these countries have publicly criticized Italy as the first G7 country to officially join of BRI. According to the Italian Minister of Economic Development, Luigi Di Mai, the aim is to correct trade imbalances between the two countries through such cooperation (Andani, 2019). On the other hand, within the EU there are countries, for example within the framework of CEE 17 + 1 cooperation, where some EU countries such as Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, as well as Slovakia, which join the BRI positively, even though there are these negatives in their case as well in cooperation with China.

As for China's most important partners from EU countries, the most involved are Germany, the Netherlands, and Italy, which also achieve the relatively highest trade intensity. Germany ranks among these countries thanks to five German-Chinese rail links: Leipzig-Shenyang, Duisburg-Chongqing, Hamburg-Zhengzhou, Hamburg-Harbin, and Nurnberg-Chengdu (Li & Taube, 2019). Probably the most famous route within the BRI is Duisburg-Chongqing. Several times a week, a train departs from Chongqing in southwestern China, one of the longest journeys in the world - 11,179 kilometres in 16 days across five countries to Duisburg in western Germany. Which is about half as few days as in conventional sea container transport through the USA. The cargo from China, in this case, consists mainly of electrical engineering from multinational companies such as Foxconn, which is a supplier to companies such as Acer, Apple, or HP. According to a representative of the German Silk Road Initiative for Germany, the BRI represents new markets, for example in Asia, Africa, as well as in Eastern and Southern Europe, which are not so well connected, in order to be able to penetrate new markets. China thus provides links, thus creating opportunities for German companies (Xinhua, 2019).

In the Netherlands, the port of Rotterdam plays a key role, with a significant share of Chinese exports going on, some of which are further re-exported to other EU countries. In 2016, COSCO Shipping Corp. acquired a 35% stake in the Rotterdam Euromax Terminal, which it bought for 47.3 mil. \$ (Nan, 2016). Rotterdam could also become a major transport hub on the emerging Arctic Silk Road, which aims to boost shipping across the north of the Asian continent. In 2013,

COSCO transported 16,740 tonnes of cargo (steel and heavy equipment) from Dalian to Rotterdam on the first ship via this route (Gudjonsson & Nielsson, 2015). A very important part of the BRI became Schiphol Airport in December 2016, which offers direct flights to several Chinese cities. With the growing popularity of e-commerce in Europe, deliveries of goods from China are also increasing, these deliveries are made by eight airlines with more than a hundred flights per week. Amsterdam Schiphol Airport is today Europe's leading air cargo product centre for customers ordering from China. The most exported goods via Amsterdam Schiphol Airport in China are products for children, fashion accessories, and cosmetics, while imports from China to the Netherlands are mainly electronics (Li & Taube, 2019). Schiphol Airport is one of the busiest freight hubs in Europe. In 2016, a freight train from Tilburg to Chengdu also started running three times a week. The route is almost eleven thousand kilometres long and the train will cross it in 15 days, which is about 30 days shorter than sea transport. The year 2018 brought a deepening of relations between the two countries within the BRI by signing a memorandum of cooperation to strengthen cooperation on the financial markets. Future cooperation is expected, especially in the field of innovation and digital technologies. For example, the Dutch company Philips has extensive cooperation with Chinese companies in the field of medical equipment, health informatics, artificial intelligence, health big data, and internet healthcare (Cong, 2019).

In March 2019, Italy as the first country among the so-called The G7 group, representing the world's seven most advanced economies, has signed an official Memorandum of Understanding on cooperation within the BRI. What it means for countries to translate mutual complementary strengths into advantages for practical cooperation and sustainable growth, supporting synergies between the Belt and Road Initiative and priorities identified in the Investment Plan for Europe and the Trans-European Networks, bearing in mind discussions in the EU China Connectivity Platform (Governo Italiano, 2019). In connection with this memorandum, a total of 29 trade agreements worth 2.8 bill. \$ were signed. The agreements cover projects in the fields of energy, finance, and agricultural production, as well as large Italian engineering companies that will be offered access to the Chinese market (BBC, 2019). Despite the relatively young partnership, significant projects were recorded. The Chinese state-owned company China Communication Construction Construction (CCCC) has announced cooperation agreements on the joint development of port projects. He will collaborate on the modernization and reconstruction of the ports of Genoa and Trieste (Si, 2019). However, Italy is publicly criticized not only by other member states but also, for example, by the USA, for deepening cooperation within the BRI. As a China-funded projects are in the form of loans, this may lead to participating countries being heavily indebted and consequently increasing their economic dependence on China and also increasing their vulnerability to their political influence. China uses this „debt trap” strategy in several countries to consolidate its strategic interests.

## **6 CONCLUSION**

Foreign trade is an important element in the long-term progress of all economies in the world economy. As the world's largest exporter and the EU's second largest trading partner, China is stabilizing its trade position and bargaining power with the EU. This fact should not be ignored by any of the EU member states (Baláž et. al, 2019). Despite the continuing trend of growing Chinese exports to the EU as well as exports from the EU to China, foreign trade between these partners has developed to the detriment of the EU over the last ten years, which is reflected in an increasing trade deficit, which currently (in 2019) represents over 151 bill. \$, which is the highest recorded value in the observed period. The analysis of trade intensity of Chinese exports from the point of view of the aggregated EU pointed to the fact that trade flows between countries are much smaller than expected, given the position of countries in the world economy.

Similar results were shown by the analysis of five countries (Germany, France, the Netherlands, the United Kingdom, Italy), which trade with China the most among the member countries.

The high intensity of mutual trade is recorded only in the Netherlands, which is mainly influenced by China's growing exports to this country, which is an important transport hub thanks to its ports. However, a declining trend in trade intensity is currently being promoted in this case as well. There is a potential limitation within the index, as it was not calculated by the EU and therefore does not reflect the activity of European exporters. The Belt and Road Initiative, an ambitious plan by the Chinese government to build and modernize highways, railways, ports and other infrastructure in Asia and Europe, could help increase trade intensity as well as reduce the trade deficit in the future. As this is an initiative of long-term, constantly developing projects with an unlimited exact completion framework, the full impact cannot be determined. However, despite the EU's long-standing scepticism about China's growing influence on European territory, cooperation within the BRI is expanding. Among the largest partners examined, according to available data, the most important cooperation is developed in Germany, the Netherlands, and Italy. Thanks to the initiative, the established rail connections, the modernization of ports and a significant reduction in the transport time of goods offer these countries access not only to the Chinese market but also to the markets of other countries along the emerging transport corridors. The implementation of the BRI brings opportunities for further research in the areas of examining current business complementarity, or comparative advantages, and other factors affecting the foreign trade of these two world powers.

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# COMPETENCES FOR LEAN SPECIALISTS IN INDUSTRY 4.0: THEORETICAL FRAMEWORK

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## **Abstract**

The contemporary increase in complexity and advancement in technologies has led to great changes in the environment. Nowadays companies should improve their capabilities in order to be on the market in Industry 4.0. Industries are challenged to fulfil different requirements not only from the technological point of view but also from the managerial. As the technologies develop, so should the knowledge and competences of qualified specialists. The aim of this paper is to systemize the theoretical knowledge on the topic of Lean competences for Industry 4.0 and to propose a framework that can be used by researchers and practitioners in the development of the competences needed for the future. This paper performs an analysis of the competences necessary for Lean specialists in Industry4.0 era, followed by a proposed competence model framework. The paper reviews the literature available on Competences for Industry 4.0 and Competences for Lean Specialists. Then a cross-sectional analysis of these competences is taken and a summary of Competences necessary for Lean specialists in Industry 4.0 is given. It is clearly established that Lean specialists do not need a sufficient change in their present competences as the major part of job profiles tend to have the requirements suitable for Lean engineers. However, Lean specialists should improve some of their abilities and skills if they want to be more competitive specialists on the market in Industry 4.0 era. The competence model proposed in this paper helps to differentiate different types of necessary competences and better understand the competence sets for future specialists.

*Keywords: Lean, Industry 4.0, competences, smart factories*

## **1 INTRODUCTION**

An increasing complexity and technological advancement have led to great industrial changes. The demands now are more personalized while the speed is faster. Considering the rapid development of technologies, the production has to be altered in order to be able to reply to market demands. The necessity of change gave birth to new industrial revolution which is called Industry 4.0.

The interest in Industry 4.0 is currently augmenting from both industrial and scientific points of view. This can be explained by the desire to improve production and to increase companies' incomes. Thus, the increasing number of attempts to develop theories on adaptation (Rossini et al., 2019), to make an assessment (Yeen Gavin Lai et al., 2019), to analyze (Leyh et al., 2017), to propose the implementation (Sony, 2017) and conceptual framework (Salkin et al., 2018) etc. are performed. All these attempts try to advance the understanding of the new concept and to make the shift into the Industry 4.0 era as smooth as possible.

With the increasing smartness of environment, a need to understand the transformation of competences accordingly has arisen. Several authors have already tried to summarize and analyze the future competences that are necessary for different specialists in the Industry 4.0 era. This is important to understand as the shift in the industrial behavior pursuing the use of Industry 4.0 technologies is unavoidably interconnected with the change in the competences of specialists of different fields. Thus, an analysis of competences connected with Industry 4.0 is becoming widespread in the latest articles.

In this paper an attempt to systemize the existing competences is made based on the theoretical review and a framework for the competence model is offered. Firstly, the theoretical background for Lean, Industry 4.0 and shift in competences is provided. Then, methodology used for systematization and analysis is explained. This is followed by the results gathered and proposed framework. Finally, in the discussions and conclusions section, some ideas on how to improve and further develop the research are introduced.

## **2 THEORETICAL BACKGROUND**

### **Lean**

Lean concept appeared as a result of success of Toyota Production System developed by Taichii Ohno (Yeen Gavin Lai et al., 2019). Lean principles became popular as Toyota could make an increase during complicated economical periods (Pereira et al., 2019). The term “Lean” became widespread with the book “The machine that changed the world”, when the authors used the term for the Toyota system (Womack et al., 2011).

The main idea of Lean methodology is to identify value creation process and to eliminate seven kinds of wastes (Womack et al., 2011), thus, creating a “smooth flow of processes” (Antony et al., 2018). In Lean the waste could be anything that does not create value (Yeen Gavin Lai et al., 2019). The seven common types of wastes are overproduction, waiting, transportation, over-processing, inventory, unnecessary motion, defects.

Although initially Lean was a methodology for industrial companies, currently Lean tools and practices are widely applied in services. The most widespread examples are Lean education and Lean medicine.

Many companies can benefit from applying Lean tools accurately (Satoglu et al., 2018) and Lean has already been proved to be successful methodology many times over several last decades. Although many organizations still struggle to understand Lean principles and practices fully (Rossini et al., 2019). Thus, the correct application of Lean tools is highly important for the success of the company.

The most popular Lean tools include Value Stream Mapping, Lean Office, Kaizen, Push and Pull, 5S, SMED, Jidoka, and others (Sony, 2017). Lean engineers should be aware of all the Lean tools, should be able to choose and apply the most relevant and should be able to launch the continuous improvement process. Considering the growing complexity of the environment and the speed of development, Lean specialists should also develop competences in reply to the change towards Industry 4.0 to be able to support industry and to participate in the market competition. In this sense the change of Lean tools as well as Lean engineers’ competences seems inevitable.

### **Industry 4.0**

The increasing complexity and ever-growing advancement of technologies have led to the fact that in 2011 at Hannover Fair the German Government has announced the term Industry 4.0 for the new forth industrial revolution (Salkin et al., 2018). The main idea of Industry 4.0 is the creation of Smart Factories where the production could be centralized, self-controlled and flexible (Leyh et al., 2017), thus, the processes could be interconnected in a smart way.

As with the previous industrial revolution, the forth industrial revolution brings attempts to improve the existing manufacturing processes in a way that they respond better to market demands (Yeen Gavin Lai et al., 2019). Considering that nowadays all kinds of products are “becoming smart” (Rauch et al., 2016) and that the demands of customers are becoming more

personalized while the industrial and technological environment is becoming more developed, the need of organizational change has appeared. This change is aimed at creation of the system where the actions and information could be connected and coordinated (Salkin et al., 2018). These gives momentum to the development of technologies that will be able to communicate and make simple decisions, thus, making the process flow independent and agile.

Nowadays Industry 4.0 technologies mainly include adaptive robotics, big data analytics, simulation, cyber-physical systems, industrial internet, cloud systems, additive manufacture and networking (Salkin et al., 2018). These technologies have great technological influence on existing practices but their application is becoming more widespread in today's industrial community. The introduction of these technologies is combined with several challenges though. One of these challenges is a necessity of a shift in competences, as Industry 4.0 can influence human resource development (Rossini et al., 2019). As Industry 4.0 aimed at creating environment where independence and flexibility would exist at all levels (Leyh et al., 2017), both production and managerial parts will be influenced by this change.

### **Shift in competences**

Industry 4.0 creates an environment when the traditional business should be changed into digital businesses (Jerman et al., 2018). This is inevitably connected with technological changes in organizations. But changes in technological environment lead to changes in competences of specialists (Jerman et al., 2018). As the technologies become more advanced so should be the general knowledge of different specialists. As such technologies as Big Data, IoT, cloud computing is not only connected with the field of informatics but also with the field of engineering, it is impossible to neglect the set of competences arising from and with the emerge of new technologies.

Enterprises nowadays face a lot of challenges as changing according to the advancing technologies is connected with a set of threads. But the need of transformation is impossible to be avoided. Although the competences of engineers could serve as a good "foundation" for the transformation of enterprises (Whitcomb et al., 2017), the need of change in these competences is still sharp.

Thus, the shift in Lean competences should also be considered, as the appropriate competence change will lead to better understanding and easier implementation of new technologies. Moreover, as Jerman, Pejić Bach and Bertoncej state the usual set of competences is not satisfactory, considering the speed of the change, and the need to understand key competences has appeared (Jerman et al., 2018). This shows the great importance of understanding the shift of key competences of Lean specialists.

This paper is aimed at providing practitioners and researchers with the overview of the competences needed for Lean specialists in Industry 4.0. This will help companies and individuals to concentrate their resources on the development and improvement of the characteristic needed for engineers.

## **3 METHODOLOGY**

The theoretical development of the research topic was conducted on the basis of systematic literature review on future competences for Industry 4.0 and competences of Lean managers. The paper focuses on findings from peer-reviewed journal papers and conference papers from two academic databases - Web of Science (Core Collection) and SCOPUS. The literature of the interest does not include news reports, reviews, textbooks or editorial materials. The leading publications from several journal databases (mainly, Elsevier, SpringerLink, Emerald)

answered the search. The emphasis was given to the up-to-date articles with a time frame of last 10 years. The results were limited only to literature available in English, thus, the outcome cannot depict the results in full-scale.

The paper offers cross-section analysis where the first part is the analysis of papers connected with competences necessary for Industry 4.0 and/or smart factories, and the second part comprises literature review of the papers on the competences of Lean specialists.

For the first part the advanced search on the competences for Industry 4.0 and analysis of the publications were performed. The results of the search were 27 articles and conference papers on Web of Science and 40 publications on SCOPUS. The publications were further analysed and the most relevant were chosen.

The research combination for the second part comprised (competence OR competency OR competencies OR job AND profile) AND Lean. The search resulted in 22 publications in SCOPUS and 12 papers on Web of Science. From these results the relevant to the topic were chosen, then the analysis and the extraction of the relevant data were conducted.

The following stage of the research was cross-section analysis where the results of two findings were reviewed from the point of view of the correlation of the data extracted.

Finally, the proposition of a competence model framework for Lean specialists for Industry 4.0 based on the cross-section analysis of literature. This competence model framework could serve as a basis for practitioners to improve the existing skills and develop the skills needed. Finally, the competences for Lean specialists in the future were proposed based on this research.

## **4 RESULTS**

### **Competences for Industry 4.0**

The first part of the analysis comprises the search for the relevant information on the competences necessary for Industry 4.0. The initial advanced search with (competence OR competency OR competencies OR job AND profile) AND (Industry 4.0 OR Smart Factory OR Fourth industrial revolution OR 4<sup>th</sup> Industrial revolution) has shown that in the last ten years several attempts were made already to systemize Competences for Industry 4.0 using Data Mining approach. The most relevant publications were chosen and analysed from the point of view of their correspondence to the main topic. Apart from the title the citation rate and the year of publications were also considered. Eventually 4 publications from the period of 2016 to 2018 were chosen where the overview and summary of competences for Industry 4.0 were given.

The results show that the competences could be divided into several groups. According to Grzybowska and Łupicka there are technical competences, managerial competences and social competences (Grzybowska & Łupicka, n.d.). Jerman, Pejić Bach and Bertoneclj after Hecklau et al. divide competences into technical (or domain-related), methodological, social and personal (Jerman et al., 2018), (Hecklau et al., 2017).

The analysis of the chosen articles allowed to identify the competences that were mentioned in all or in the majority of the articles. The complete list of all the competences, mentioned in the chosen articles is given in Table 1.

The most popular Technical competences for Industry 4.0 era were identified as process understanding, coding and understanding of digital security. Methodological competences were analytical, problem solving, decision making, and creativity. Social most needed competences

are communication and leadership. As Industry 4.0 is about agile and complex environment, the most important Personal competences are flexibility and adaptivity and willingness to learn.

Tab. 1 – Competences needed for Industry 4.0. Source: own research

Technical Competences	Process Understanding	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Coding	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	IT/Digital security	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Technical skills	(Hecklau et al., 2016), (Jerma et al., 2018)
	Media skills/operation of new technologies	(Hecklau et al., 2016), (Jerma et al., 2018)
	State-of-the-art knowledge	(Hecklau et al., 2016),
	Digital network	(Hecklau et al., 2017)
	Interdisciplinary	(Hecklau et al., 2017)
Social Competences	Communication and networking skills	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Leadership	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Language skills	(Hecklau et al., 2016), (Jerma et al., 2018)
	Team working	(Hecklau et al., 2016), (Jerma et al., 2018)
	Ability to transfer knowledge	(Hecklau et al., 2016), (Jerma et al., 2018)
	Seeing the big picture	(Jerma et al., 2018)
	Compromising and cooperative	(Hecklau et al., 2016)
	Intercultural skills	(Hecklau et al., 2016)
Methodological Competences	Analytical	(Hecklau et al., 2016), (Hecklau et al., 2017), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Problem solving (incl. complex problem)	(Hecklau et al., 2016), (Hecklau et al., 2017), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Decision making	(Hecklau et al., 2016), (Hecklau et al., 2017), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Creativity (once in personal competences)	(Hecklau et al., 2016), (Hecklau et al., 2017), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Conflict solving	(Hecklau et al., 2016), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Research Skills	(Hecklau et al., 2016), (Grzybowska & Łupicka, n.d.), (Jerma et al., 2018)
	Entrepreneurial thinking	(Hecklau et al., 2016), (Grzybowska & Łupicka, n.d.)
	Efficiency orientation	(Hecklau et al., 2016), (Grzybowska & Łupicka, n.d.)
Personal Competences	Flexibility and adaptivity	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Willingness to learn	(Hecklau et al., 2016), (Hecklau et al., 2017), (Jerma et al., 2018)
	Ability to work under stress and pressure	(Hecklau et al., 2016), (Jerma et al., 2018)
	Social responsibility	(Jerma et al., 2018)
	Ability to analyse the importance of information	(Jerma et al., 2018)
	Ambiguity tolerance	(Hecklau et al., 2016)
	Compliance	(Hecklau et al., 2016)
	Sustainable mindset	(Hecklau et al., 2016)

## Lean competences

For the second part of the research the detailed search was done. The elimination of similar publications at Web of Science and SCOPUS has cut the search to 24 publications. After the analysis of the titles and abstract the amount of results were shortened to 7 publications. The thorough analysis of the information in these publications allows to summarize competences necessary for Lean practices.

Some authors use typical division of Lean Competences into personal, methodological, social and professional (Wafae & Abderrazak, 2019). Others divide all competences into Technical Competence, Social competence and Enterprise vision (Pavez & Alarcón, 2012). As previously Competences necessary for Industry 4.0 were divided into technical, methodological, personal and social, in this paper an attempt was made to summarize the competences and divide them according to the above-mentioned categories. The competences are overviewed in Table 2.

Tab. 2 – Competences needed for Lean specialists. Source: own research

	Competences	References
Technical Competences	Specific knowledge (Lean theory, tools)	(Wafae & Abderrazak, 2019), (Pavez & Alarcón, 2012), (Mrugalska, 2020), (Kregel et al., 2019), (Souza et al., 2019), (Seidel et al., 2017)
	Professional Skills (Project Expertise)	(Wafae & Abderrazak, 2019), (Kregel et al., 2019)
	Ability to recognize and solve problem	(Wafae & Abderrazak, 2019), (Seidel et al., 2017)
	Continuous improvement	(Salvatierra et al., 2016), (Mrugalska, 2020), (Souza et al., 2019), (Seidel et al., 2017)
Methodological Competences	Context knowledge (Software skills)	(Kregel et al., 2019)
	Analytical	(Wafae & Abderrazak, 2019), (Mrugalska, 2020), (Kregel et al., 2019), (Souza et al., 2019)
	Decision making	(Wafae & Abderrazak, 2019)
	Enterprise vision, commitment	(Pavez & Alarcón, 2012), (Souza et al., 2019), (Seidel et al., 2017)
	Innovation orientation	(Salvatierra et al., 2016), (Seidel et al., 2017)
Social Competences	Change orientation	(Salvatierra et al., 2016)
	Focus on result	(Souza et al., 2019), (Seidel et al., 2017)
	Interaction and communication skills	(Wafae & Abderrazak, 2019), (Kregel et al., 2019), (Souza et al., 2019)
	Team working	(Wafae & Abderrazak, 2019), (Souza et al., 2019)
	Client orientation	(Salvatierra et al., 2016), (Seidel et al., 2017)
Personal Competences	People expertise (Ability to inspire, Resistance management)	(Pavez & Alarcón, 2012), (Wafae & Abderrazak, 2019), (Kregel et al., 2019), (Souza et al., 2019)
	Teaching	(Souza et al., 2019), (Seidel et al., 2017)
	Flexibility and adaptivity	(Wafae & Abderrazak, 2019)
	Developing the personality	(Wafae & Abderrazak, 2019), (Seidel et al., 2017)
	Leadership	(Mrugalska, 2020), (Kregel et al., 2019), (Seidel et al., 2017)
	Motivation	(Souza et al., 2019)
	Long term views	(Seidel et al., 2017)

As it can be seen from the table some competences were mentioned by all or the majority of authors, while some competences were identified once. According to the table the most needed competences for Lean specialists are theoretical knowledge (as all the authors mentioned this competence), analytical knowledge or the ability to perform analysis, communication skills, people expertise and leadership.

It is important to note that Lean specialists are considered to be forward-thinking specialists. This can be seen as such competences as innovation, change orientation long-term view were mentioned by several authors. Considering the fast-developing world and the difficulty of forecasting the future technological tendencies, it might be a good quality to be considered as one of the key Industry 4.0 competences.

### Competences for Lean managers in Industry 4.0

The comparative analysis of Competences for Industry 4.0 and Competences for Lean engineers shows that although some of the competences are same, the difference in skills should be considered.

In technical competences Lean specialist should emphasize lean tools knowledge and practical application, while the most important for Industry 4.0 are considered to be coding and digital security. Although technical skills are important for both, Lean engineers might need to deepen their knowledge on digital technologies for the future.

Methodological competences are similar in both groups in many ways. The most important for both groups are analytical skills, as it is important for Lean engineers as well as for the engineers in Industry 4.0. Other important skills are decision making and problem solving (although in Lean this competence is in technical category). Also, the result orientation is important for both groups. Innovation orientation is considered to be essential for Lean managers, while Industry 4.0 emphasize the research skills. The combination of these competences can provide greater success as it will allow the specialists to be forward thinking and agile.

Communication, teamwork and ability to transfer knowledge are characteristic for Lean and Industry 4.0 Social competences. These skills are critical because they allow to make the work with people successful and avoid stresses and conflicts. It is also important to note that language skills were mentioned in Industry 4.0 competences, as with the opening of the borders, especially together with the technological development, these skills should also be considered as essential for Lean managers.

The personal competences include flexibility and adaptivity, willingness to learn and leadership. As leadership is one of the skills, it is important for the leader to understand the changing environment and to act accordingly. This can be achieved only when leader is flexible and willing to learn. Thus, these characteristics should also be considered as important for Lean engineers in Industry 4.0 era.

### **Competence Model Framework**

The systematization of Lean competences and competences needed for Industry 4.0 could serve as a basis for competences model framework. A framework proposed by Mulder could serve as a foundation for Lean competences model framework for Industry 4.0, as according to the author this “model could be applied to all professions” (Mulder, 2017). The model proposed by Mulder is called Five-Component Future Competence Model (5CFC Model). The 5CFC Model consist of 5 components: vertical dimensions comprise Self-management and career competence and Disciplinary and interdisciplinary competence; horizontal dimensions consist of Personal-professional competence and Social-professional competence. In the centre of 5CFC Model is Integrative learning competence.

In our case, as it was already mentioned, considering the speed of change and the working environment the shift in the competences is inevitable. Thus, the integration of new competences in all 4 types, learning and improving is important to be in better demand as specialist on the market. Lean specialists have to be able to learn new competences in all 4 types mentioned above. So, the central competence of Integrative learning is necessary for all 4 types mentioned prior in our research.

In this paper 4 types of competences are similar to those, proposed by Mulder. Personal-professional competence correlates with Technical competences as both comprises professional skills that are connected with innovations. Social-professional competence is similar to Social competences as they both contain skills on communication and negotiation. Disciplinary and interdisciplinary competence corresponds to Methodological competences as both are connected with seeing the “bigger picture” on several levels. And Self-management and career competence is comparable to Personal competences as they are associated with self-regulation and leadership skills.

The competence model framework for Lean specialists in Industry 4.0 era could be seen on

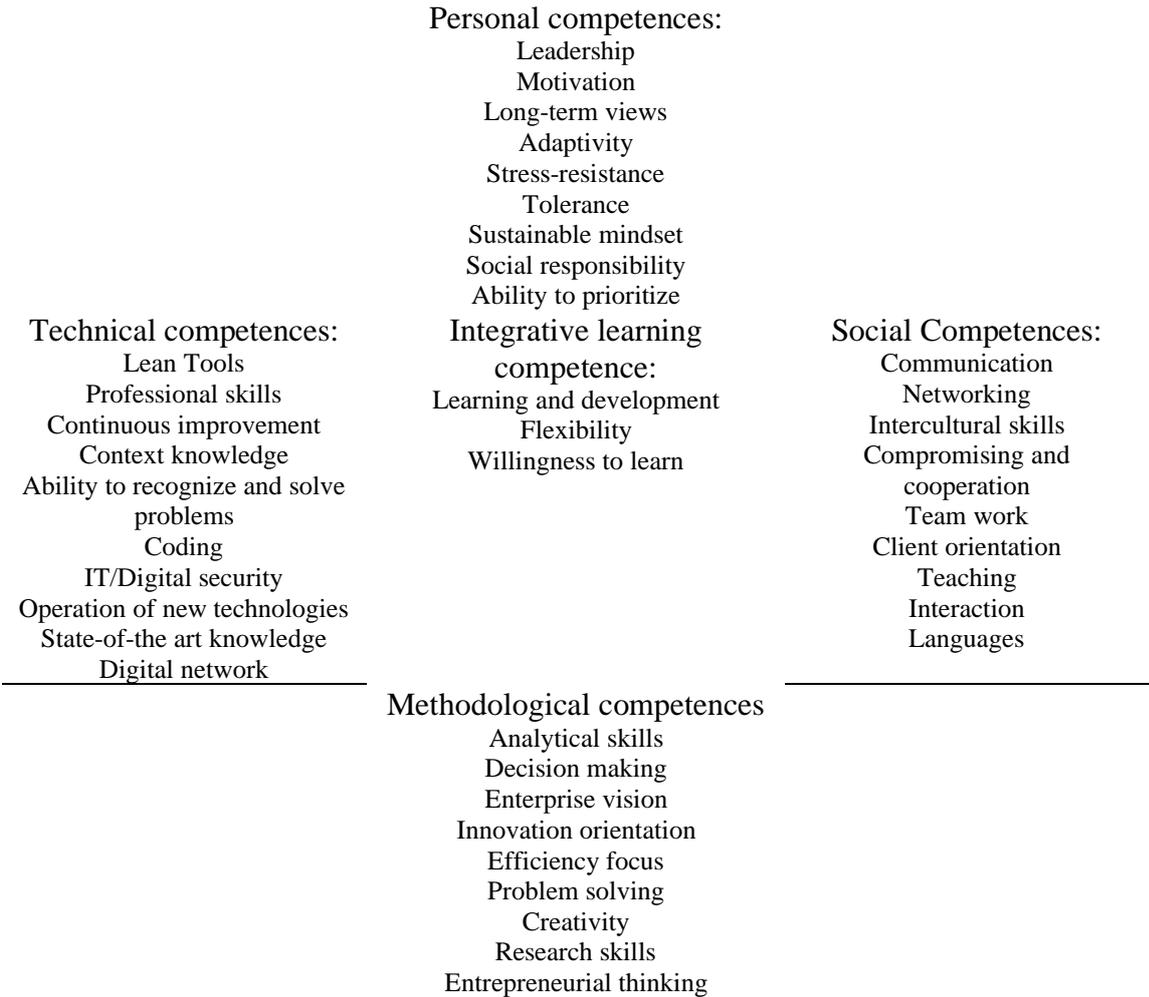


Fig. 1 – The Competence Model Framework for Lean Specialists in Industry 4.0. Source: own research

**5 DISCUSSION**

In this paper an attempt was made to systemize Lean competences necessary for Industry 4.0 era. The systematisation was based on the cross-section analysis of Lean Competences and Competences necessary for Industry 4.0. It is important to understand that only theoretical information was gathered. The search was limited to conference papers and articles in English.

In the future the research could be deepened by gathering the qualitative data from practicing specialists and quantitative analysis of the data. Also, the research could be improved by the analysis of necessary competences development in time and the comparison to the competences mentioned. Other improvements include search in other languages and/or other sources.

As the competence model framework is offered in this paper, it was based on the theoretical information gathered by systematic literature review. The opinion of practitioners and further development of the model might be complementary to this research. The gathered feedback could help to refine the competence model. Thus, the research gap for further development includes the gathering data from practitioners and data in other languages.

## 6 CONCLUSION

The change in everyday life and the shift towards Industry 4.0 influence all the fields of life. The competences and the job profiles of different specialists are to be changed accordingly. The increasing interest towards Industry 4.0 results in the increasing number of publications, including the publications concerning competences for Industry 4.0. This paper has an attempt to identify the necessary competences for Lean engineers for Industry 4.0.

As Lean is connected with the third industrial revolution, as it was introduced as a change to mass production, Lean has big potential in Industry 4.0 era. Although Lean specialists should be prepared for the change and should develop necessary skills, abilities and competences to achieve market success.

The competence model framework proposed in this study can be further used for theoretical researches and practical application and serve as a basis for Lean Specialists in the future.

It is necessary to mention, that according to the research, the competences of Lean specialists for Industry 4.0 should not be changed greatly. Thus, it gives a benefit to the existing engineers that instead of complete re-education they can deepen necessary knowledge and improve their skills and be a sought-after specialist on the market when the complexity and speed of change are augmenting.

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# USE OF PROJECT MANAGEMENT MATURITY MODELS AS A EVALUATION FRAMEWORK FOR PROJECT RISK MATURITY ASSESSMENT

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## **Abstract**

Management of project risks has a significant impact on the success of the entire project. The importance of project risk management also means the need for continuous measurement and development of this area. Considering the existence of few specialized maturity models for this area, the aim of this paper is to analyse the extent to which it is possible to use commonly used project management maturity models (PMMMs) as a full-fledged tool for the evaluation of project risk management maturity. Based on the literature review and selected methodology, the four most frequently used models of maturity (CMMI-DEV, OPM3, PMMM, KPMMM) are analysed in more detail. Despite the predominantly exploratory nature of this paper, based on four defined criteria, three of the above PMMMs can also be used as models for evaluating and improving Project Risk Management. While one of the outputs of this paper is the creation of an evaluation scale for the PRM assessment, based on the regularities of the models used. By outlining the possibility of using already existing PMMMs, the results of this paper contribute to the evolving field of improving the management of project risks as a key project management area. In addition, results point out the expanded use of already existing PMMMs.

**Keywords:** *project risk management, maturity model, project management evaluation, risk management maturity, PRM, CMMI, OPM3*

## **1 INTRODUCTION**

An integral part of project management is management of project risks. Namely, the degree of uncertainty in the project management environment is analogously linked to the potential existence of risks. Thus, project risk management is a core discipline in most industries and can be defined as a process that dynamically minimizes the level of risk by identifying and evaluating potential risk events, developing a response plan, and actively monitoring risks during project implementation. (Irizar and Wynn, 2018)

In contrast, Nicholas & Steyn (2017) claim that project management itself is a method of minimizing the risk associated with uncertain behaviour. One way or another these two areas are closely interlinked and thus the ability to manage project risks has a key impact on the future success of the project, which is also confirmed by some authors, while the quality of the risk management process in projects is then derived primarily from the maturity of the organization in this field. (Crispim et al., 2018, de Carvalho & Rabechini Junior, 2014)

So-called maturity models are used as tools for systematic improvement and measurement of the levels of individual business areas. Due to the different views on the very concept of maturity, there is a number of models that evaluate the organization in different ways. Based on literature reviews there is up to 60 model for assessing project management maturity. (Iqbal, 2013)

Despite the close link between successful risk management and project success, very few contributions and models were developed specifically address this area. In the area of project risk management maturity (hereinafter as PRMM), four models have been developed in last

decade. (Hopkinson, 2012; Hartono et al., 2014; Irizar & Wynn, 2018; Chapman, 2019). However, their widespread acceptance is hindered by their applicability only in some of the industrial areas, such as the construction industry (Hartono et al., 2014), automotive (Irizar & Wynn, 2018) or areas that do not involve creating permanent physical assets on the ground. (Chapman, 2019)

Previously identified barriers of the use of project maturity models, such as small size of company, cost difficulties and time-consuming assessment (Staples et al., 2017), are thus emphasized in the case of improvement of only one of the key project areas.

One of the ways to overcome the shortcomings resulting from the models tailored for selected industry or from assessment specified only on specific project area, is to use general models for project management maturity. However, this procedure is conditioned by the assumed possibility to evaluate only partial project areas within the assessment.

In line with this statement, the aim of this work is to examine the extent to which existing general maturity models can be used to improve and evaluate PRMM, which would provide both insight into project management as a whole and its individual areas, and including risk management. The procedure used (creation of a new model based on the principles and knowledge of the previously created model) also fully respects the principles that are commonly applied in the field of maturity model's development. (Backlund et al., 2014)

Given that many of the models used are based on the PMBOK methodology (2004), which considers risk management as one of the knowledge areas of project management, it is assumed that this procedure will be applicable. Given that each maturity model should also provide a basis for further improvement, then such evaluation should allow the area of project risks to be further improved. (Crawford, 2014)

## **2 THEORETICAL REVIEW**

With regards to the objectives of this work, the theoretical background is defined in this part. On this basis, some sub-models will be analysed later. The following section summarizes the research on the topic of project management maturity and use of project maturity models.

### **Project management development within organizations**

The development and improvement of project management in organizations is associated with the new millennium and businesses processes maturity efforts. (Cooke-Davies & Arzymanow, 2003, Mullaly, 2006) When searching for a definition of the term "maturity", at least two possible definition are available. For example, Crawford (2014) or Nicholas & Steyn (2017) consider an organization's maturity as an organization's ability to achieve consistent results, while Gartner (2012) deduces project management maturity as an organization's ability to embrace such things as project management or portfolio management, and at what level of complexity and effort. Based on analysis performed in recent years (Backlund et al., 2014, Görög, 2016), the organization's maturity in project management is then determined by two main factors: (a) Appropriate and efficient use of project management toolkit and knowledge; (b) Appropriate placement of project management into the organizational strategic context.

As concluded, for example, by Clealand & Bidanda (2015), projects do not take place in isolation and self-servingly, but always have a linkage to the strategic goals. For example (Cooke-Davies et al., 2009, Project management institute, 2013)

Research conducted since the anchoring of the term "maturity" derive a number of both internal and external benefits associated with increasing maturity in organizations, such as increased

quality of outputs (Crawford, 2014, Mikosik, 2014), optimizing the organization's risk management, improving the organization's human resources management motivating organizational culture. (Klein et al., 2015, Miklosik, 2014, Selleri Silva et al., 2015), the establishment of project standards in the organization (Irfan et al., 2019), a proactive and systematic approach to problem solving (Bharathi et al., 2012), increased reputation of the organization in the market (Miklosik, 2014, Nicholas & Steyn, 2017) or gradual expansion of competitive advantages. (Miklosik, 2014, Nicholas & Steyn, 2017).

In summary, high maturity of project management refers to positive effect on performance (Albrecht & Spang, 2014, Irfan, 2019, Klein et al., 2015, Mullaly, 2006) However, based on some other research, there is a paradigm shift in this regard, where for example Yazici (2009) finds that project performance is also determined by organization culture to a great extent. Brooks et al. (2014) generally mention insufficient empirical evidence of the linkage between performance and maturity.

Part of the research has just been devoted to the role of complexity to the need to increase the maturity of the organization and the corresponding higher performance of the organization. However, the previously demonstrated amplifying effect on performance (Albrecht & Spang, 2014, Backlund et al., 2014, Demir & Kocabas, 2010) or on high-level of maturity in a more complex environment (Pretorius et al., 2012) is partially negated by recent research (Ogonowski & Madziński, 2019) of the largest Polish logistics organizations, which points to the low maturity of these organizations and to the unsystematic approach to project management.

The context of the organization then has its role in the maturing process as well. Pasian & Williams (2014) mention the role of non-process factors here, especially in case of “human factors”. For example, in the case of involving senior management in the whole process (Crawford, 2014; Nicholas & Steyn, 2017), which is also related to the above-mentioned determinants of maturity.

Although improving project management through maturity models can be mistaken for panacea (Crawford, 2006), it can be concluded that the success of sub-projects is determined by significantly more factors. Long-term effort is then associated with investment and related pressure on efficiency. Thus, it is always necessary to consider the future profitability of the whole effort. (Project management institute, 2013) Each organization achieves its effectiveness at a different level of maturity.

### **Use of Project Management Maturity Models**

As Cleland & Bidanda (2015) mention, so-called maturity models have been developed with the need to look beyond the level of sub-project management and to map the current project management system in the organization. More precisely, maturity models are considered as a tool that can be used to measure and evaluate individual partial aspects of project management of the organization. (Nicholas & Steyn, 2017)

However, the applicability of the models does not end with the measurement itself. Determining the level, on the one hand, allows the organization to know its position and its shortcomings, and, by analogously the results point to the possibilities for further improvement and its form. As Crawford (2014) adds: "By compiling its own evaluation, the company shows, among other things, the will to improve its processes."

According to Iqbal (2013), there are already more than 60 different models and their variants as there was about 30 such models identified ten years earlier (Grant & Pennypacker, 2006). This fact is given by very nature of maturity assessment, where there is no type of model or

specific model that is universally applicable and useful for any kind of organization. (Backlund et al., 2014) This is based, among other things, on the different ideas and needs of organizations regarding the improvement of their competencies. Thus, some models are usually used in given industry.

Along with the development of new models, the principles of how to further categorize models are also developing. Within the models of maturity, two main categories are considered: (a) Hierarchical models - maturity is characterized by the number of skills and competencies that the organization has; (b) Process models - assessment of maturity based on the areas that the company considers in project management (Tahri & Drissi-Kaitouni, 2015).

Some authors also propose other categorization options, probably in connection with the growing number of models, for example Torres (2014) divides models according to the approach of determining the level of graduation (staged models and continuous models), Görög (2016) then expands the possibilities of categorization further by underlying notion, primary aim of assessment and type of assessment.

Part of the papers on the topic of maturity models deals with criticism, which mainly concerns the shortcomings of the models themselves or the identification of barriers to use. Due to the nature of the similarity of certain models, as there are built on the similar principles (Ferreira de Souza & Gomes, 2015, Görög, 2016), these characteristics are common to all the models created so far. The main shortcomings of the models compiled so far are considered to be too much emphasis on explicit knowledge of the organization and underestimation of the role of tacit knowledge, (Görög, 2016, Nicholas & Steyn, 2017) for example in the form of competencies and experience of project managers, which are not transferable but largely determine project success. This factor has already been mentioned in the previous section, in relation to the limits of maturity and performance.

Another criticism concerns the overemphasis on the procedural side of evaluation, where the condition for compiling is a procedural view of the organization (Görög, 2016), insufficient consideration of the organizational context (Irizar & Wynn, 2018) and last but not least the difficulty of compiling the assessment. (Tahri & Drissi-Kaitouni, 2015)

On the specific example of the CMMI model, Staples et. al (2007) deals with the topic of the difficulty of assessing the evaluation, which is also a barrier to the use of models. In this case, barriers are given primarily by the size of the organization, which "does not have enough time to implement", has "constrained budget or "the methodology is not applicable to the projects of given organization". (Staples et. al, 2017) Another barrier to long-term use identified is the fact that while in the primary stages the transition to a higher level is relatively easy, most companies never surpass the second level of maturity, either in terms of the difficulty of moving to a higher level or achieving efficiency at this point. (Crawford, 2014, Mullaly, 2006, Staples et al., 2007) Keshta (2020), in this context, then reveals that only a small number of organizations make full use of the models.

From the perspective of the analysis of partial models, only one research has so far focused on the frequency of use of partial types of models (Ferreira de Souza & Gomes, 2015). The remaining part of the research mainly deals with the study of specific models. From this perspective, the greatest attention so far has been given to CMMI models and their counterparts. This is also confirmed by relatively frequently created standards and methodologies based on CMMI model (von Wangenheim et al., 2010, Cheng et al., 2011, Septiana Pane & Sarno, 2015, Domínguez et al., 2018, Gonçalves et al., 2018).

In general, models of maturity are constantly evolving. One direction of development may be the replacement of shortcomings of existing models (e.g. Görög, 2016), another in tailoring the

models to a certain industry (e.g. Čech et al., 2018) or in developing models for certain project sub-areas (e.g. the section 0).

### **Project risk management maturity models**

The development of maturity models, which would be designed specifically for PRM, was preceded by the previous identification of risk management as one of the determinants of project success. Mishra et al. (2015) examined whether a higher level of maturity measured by the CMMI model can mitigate the negative effects of project risks on project performance. Crispim et al. (2018) tried to compare the maturity of PRM to the performance of the project. Finally, de Carvalho & Rabechini Junior (2014) examined the relationship between risk management and project success.

In all the mentioned research, the connection between PRM and project success / performance was confirmed to some extent. Although, for example, Mishra et al. (2015) concludes that in cases where low levels of project risk, increasing levels of the maturity process can adversely affect project performance. De Carvalho & Rabechini Junior (2014) and Crispim et al. (2018) then point to the fact that PRM has an impact on the project success, but with regard to the complexity of the project. The need to create a specialized model is indirectly mentioned by Papke-Shields et al. (2010), who point out that despite the fact that elements of management are one of the competencies of project management, this area is consistently found to be immature. The positive impact of PRM maturity was last investigated last year. (Hartono et al. (2019)

In terms of modelling for PRM, there are currently four different models (Hopkinson, 2012; Hartono et al., 2014; Irizar & Wynn, 2018; Chapman, 2019), where modelling for PRM is associated with the adaptation of risk management models to need for projects. Hopkinson's Project Risk Maturity Model (Hopkinson, 2012) is an extension of Hilson's model of assessing risk management capability against recognized standards (Irizar & Wynn, 2018). Irizar & Wynn (2018) is then based on Hopkinson's model, tailored directly for the needs of the automotive industry. The model from Hartono et al. (2014) is also validated, but for construction industry.

The most recently developed model is Chapman's model, which, unlike the current models, considers three critical areas affecting PRM, namely the objectives of PRM, core PRM activities and barriers to the implementation of effective PRM. (Chapman, 2019)

## **3 METHODOLOGY AND RESEARCH OBJECTIVES**

Given the nature of the research question, this research is considered as qualitative exploratory research. According to Lune & Berg (2017), such a design is approached in cases where the methodological approach is particularly appropriate for research that seeks f.e. to explore real linkages and processes in organizations. (Marshall & Rossman, 2014) In the case of this work, it is an examination of the possibility of the application Project Management Maturity Models in organizations, as a tool for evaluation of Project risk management maturity.

Based on the above literature review, the comparative criteria will be defined and suitable models will be selected (Flick, 2014). Selected models will consequently be compared in order to sufficiently respond the research question. The detailed description of research steps is revealed in following sections.

### **Comparative criteria**

The next step in the research is the definition of comparative criteria, which are defined based on the required characteristics of the considered PRMMM.

Comparative criteria are defined and explained based on the literature review and are defined as follows:

The expected characteristic of the maturity model is the ability to accurately determine the level of maturity (Crawford, 2014). This assumption is also based on a staged approach of maturity improvements. (Tahri & Drissi-Kaitouni, 2015, Torres, 2014) Thus, each of the selected models will be evaluated in terms of the assessment processing system, so as to provide comparable possibilities with the already created models of PRMMs.

The second precondition for the suitability of the model is the fact that, based on the assessment the process (PRM) itself can be subsequently improved. (Crawford, 2014, Project Management Institute, Inc., 2013) This characteristic will be examined in selected models whether the model itself distinguishes PRM as the whole process or whether the key aspect of risk management are distinguished as well.

If the standard model is to be used to improve PRM, it must provide a "roadmap" for improvement according to the required characteristics. (Crawford, 2014, Demir & Kocabas, 2010) Criterion analyses the extent of how the PRM maturity can be evaluated regardless the overall project management maturity.

As mentioned in the literature review (Hartono et al., 2019), the term maturity is not clearly defined. Being inspired by Görög's classification (2016), this comparative criterion compares the way the maturity is increased within a given model.

### **Selection of suitable models**

As the comparative criteria were defined, the selection of suitable models follows. Respecting the common methodology (Flick, 2014), the sampling is oriented on formal and substantial criteria. Criteria of selection has to be driven by the representativeness of a sample for the population. (Flick, 2014) In case of this research, the analysis was limited to the four most frequently mentioned models, based on research from 2015. (Ferreira de Souza & Gomes, 2015). This procedure is also chosen on the assumption that the existing models are similar in their functionality and principles of evaluation. (Ferreira de Souza & Gomes, 2015, Görög, 2016) In accordance to this statement, in the end the research is supposed to make statements that can be applied not just for selected samples but can be widely applied. (Lune & Berg, 2017)

Consequently, the following models of maturity will be further evaluated: (a) Capability Maturity Model Integrated (abbreviated as CMMI); (b) Organizational Project Maturity Model (OPM3); (c) Project Management Maturity Model (PMMM); (d) Kerzner's Project Management Maturity Model (KPMMM).

In accordance with the exploratory nature of the research questions of this paper, the partial models will first be described and analysed in detail so that the models can be evaluated in individual aspects.

## **4 ANALYSIS OF SELECTED MATURITY MODELS**

### **Capability Maturity Model Integrated**

Developed by PM Solutions, the CMMI model uses the ten knowledge areas listed in the PMBOK® Guide (2004) and is developed in collaboration with industry, government and academia. (Crawford, 2014; Ferreira de Souza & Gomes, 2015) In contrast to the originally developed CMM model, it can be used in other industries than just software and IT development. Even so, it is used mainly by organizations in this industrial area. (Crawford, 2014)

### Evaluation methodology and scale

The CMMI defines two different approaches to improvement (Selleri Silva et al., 2015). While the first approach allows organizations to improve processes gradually, in individual areas, the second approach allows for improvements based on the improvement of sets of related areas. There are two different scales and two different perspectives for improvement for these needs: (a) Capability level; and (b) Maturity level.

Capability is assessed separately for each of the organization's 22 defined processes, on 4-point scales. On the other hand, maturity is defined in five levels and depends on the number of controlled processes of the organization and their maturity, in five levels. (Chrissis et al., 2011)

Based on the methodology of the model, it follows that the organization can achieve the required maturity only if all the defined processes for this level and all lower levels are sufficiently mature. Although the maturity model itself defines the required areas (processes), it no longer specifies the specific steps to be taken to achieve a given level of maturity. (Chrissis et al. 2011; Keshta, 2020)

### Risk management within the model of CMMI-DEV

Within this model, risk management is one of 22 defined processes, and is assigned to the area of project management processes falling within the framework of the organization's 3 degree of level of development. At the same time, a link to other defined processes in this level is determined, namely within the process of Project Management Integration (IPM) and Quantitative Project Management (QPM). The defined goal of this process is: "Identification of potential problems before they occur, so that individual steps can be planned and implemented as needed throughout the project" (Chrissis et al., 2011)

The specific objectives of this process include preparatory risk management activities, risk identification and analysis, and risk mitigation. The first step is the activity of defining a risk management strategy, which usually takes the form of an established risk management plan. The second step is to define how to identify and analyse risks. The last area is the definition of steps defining the possibilities of risk treatment and their monitoring in case tolerable limits for risk acceptance are exceeded (Chrissis et al., 2011)

In accordance with the methodology for measuring maturity, this process can be characterized at individual levels even in the case of risk management. Due to the interweaving of a tiered and gradual approach, a total of 6 possible combinations of process maturity and the level of maturity of the organization are defined. The levels are defined in Tab. 1.

Tab. 1 - Project risk management maturity model (CMMI). Source: based on Williams (2006)

<b>Capability level</b>	<b>Maturity level</b>	<b>Description</b>
0 – Incomplete	1 – Initial	Risk management is either not implemented or is only partially implemented. One or more specific risk management objectives are not met.
1 – Performed	2- Managed	The organization's risk management procedures satisfy all the specific objectives.
2 – Managed (3 – Defined)		Risk management is planned and implemented in accordance with the principles of the organization, employs qualified people who have sufficient resources to produce controlled outputs, includes relevant stakeholders; is monitored, controlled and controlled; and is evaluated for adherence to the process description.
3 – Defined	3 – Defined	Risks are managed on the same principle as in the previous level. However, the process is already modified according to the process standards of the organization.
	4 – Quantitatively managed	In contrast, the risks are managed by statistical and other quantitative techniques. Quantified process goals are set. The quality and performance of the process is understood on the basis of quantifiable data.
	5 – Optimizing	Quantitative management process adapted to be able to meet both current and anticipated business goals. The process is constantly optimized. Deviations in process outputs are minimized.

The above table shows that in the perspective of the CMMI model, the specific form of the risk management process is determined both by the capability but also by the maturity of the entire organization. In this case, risk management is determined by the ability of the process to meet all specific process objectives and by process management principles within the organization. (Williams, 2006)

**Organizational Project management maturity model (OPM3)**

OPM3 was developed to provide organizations the way how to understand project management and measure maturity despite a comprehensive and broad set of best practices in project management (Ferreira de Souza & Gomes, 2015)

Project Management Institute, Inc. (2013) then describes the model as follows: "OPM3 is the integration of people, knowledge and processes that are supported by tools across all domains based on a value strategy for a given target market." (Project Management Institute, Inc., 2013)

Evaluation methodology and scale

Maturity is assessed in the model by comparing the current state of the organization with pre-defined "best practices", of which the model considers approximately 600. (Matassa, 2006) Maturity itself is then defined based on whether and, if so, to what extent the "best practices" are applied in organization. At the same time, each of the practices is assigned to a certain level of continuous improvement, which is defined by a total of four.

The maturity assessment itself, as with other maturity models (such as PMMM), outlines a possible way forward for improvement, in the context of defined best practices. The basis for improvement and thus increasing maturity is the so-called "improvement planning directory", which lists all the best practices, a description of their optimal state, a list of competencies necessary to fulfil them and their connection with other practices. Based on this basis, the organization can prioritize partial steps, either regarding to the expansion of competencies, or by expanding the applied practices. (Project Management Institute, Inc., 2013)

Risk management within the OPM3

The link to project risk management can be found in this model in the knowledge base, which defines individual best practices based on the PMBOK Guide (2004). Specifically, these are 6 partial processes of standard project risk management. All of these processes are defined in the following Tab. 2, where the processes within the individual phases of improvement are also described.

Tab. 2 - Project risk management maturity model (OPM3). Source: own processing based on PMI, Inc. (2013)

Process / Improvement phase	Standardize	Measure	Control	Improve
Plan Risk Management	Standards are established	Measures are established, assembled, and analysed.	Controls are established and executed to control the stability of the process.	Process problem areas are assessed, root causes are identified, process improvement recommendations are collected, and process improvements are implemented.
Identify Risks				
Qualitative risk analysis				
Quantitative risk analysis				
Plan Risk Responses				
Project control risks				

The PRMM level fully corresponds to the principles of evaluating the PMM, while the maturity of each sub-process can be defined. (Project management Institute Inc., 2013) A closer analysis of the "improvement planning directory" could also compile a functional model of project risk management maturity, which would consider both individual and related processes, necessary competencies and other related best practices.

## Project management maturity model

The Project Management Maturity Model (PMMM) is a formal tool developed by PM Solutions that seeks to measure maturity in an organization's project management. The goal of the PMMM methodology, according to author (Crawford, 2014), is to enable any organization to develop project management skills systematically and effectively. (Ferreira de Souza & Gomes, 2015)

### Evaluation methodology and scale

The evaluation principle is based on the above CMM model and works with 10 knowledge areas of project management defined in the PMBOK® Guide (2004). The model has five different levels of maturity.

Each of the defined 10 knowledge areas is further divided into several knowledge sub-areas within the evaluation, while the maturity of each of them is evaluated. This assessment is determined based on a predefined description for the sub-area. The maturity of each of the areas is given by the lowest level within the given knowledge area. The maturity of project management in an organization is then determined on the same principle based on the maturity of each of the 10 knowledge areas. (Crawford, 2014)

The evaluation of an organization's maturity is therefore derived from the least developed sub-region across the organization. Thus, a gradual improvement in the maturity of the organization occurs by eliminating weaknesses in the competencies of the organization.

### Risk management within the PMMM

Within the PMBOK (2004), risk management is defined among 10 knowledge areas of project management. Due to the evaluation system within this model, the area of risk management is also evaluated individually.

Based on the theoretical definition, as within the OMP3 model, risk management is divided into six key components, while the risk management documentation system is also considered. The table below defines the individual levels of maturity within the PMMM model.

Tab. 3 - Project risk management maturity model (PMMM). Source: own processing based on Crawford (2014)

	<b>Initial Process</b>	<b>Structured Process and Standards</b>	<b>Organizational Standards and Institutionalized Process</b>	<b>Managed Process</b>	<b>Optimizing Process</b>
<b>Risk management Planning</b>	No risk management plan defined.	Existing risk management plan mainly for large projects.	The plan is used by all projects, individual areas of risk management are specified.	The principles of risk management are adapted to the needs of each project.	Value and improvement are key aspects in drawing up risk management plans.
<b>Risk Identification</b>	Risks are not identified systematically.	There is a framework plan for identification, focusing on key areas.	Documentable and repeatable process of risk identification in projects.	Full integration of risks into the cost plan and project schedule.	Continuous improvement of the risk identification process.
<b>Qualitative Risk Analysis</b>	Improvised method of analysis.	Standard methodology, usually a three-step approach.	Methods of analysis are more sophisticated.	Advanced methods are used to estimate the impact on most aspects of the project.	Analysis based on previous experience, continuous improvement of analysis methods.
<b>Quantitative Risk Analysis</b>	Improvised method of analysis.	Standard methodology, semiquantitative approach.	Advanced quantitative methods.	Advanced methods are used to estimate the impact on most aspects of the project. Measuring the effectiveness of measures.	Analysis based on previous experience, continuous improvement of analysis methods.
<b>Risk Response Planning</b>	Reactive approach.	Basic methodology, basic integration with the project plan.	Standardized measures. All risks of the project are addressed.	Full integration with cost plans, schedule and other project areas.	Retrospective evaluation of the effectiveness of the measure, even on the basis of drawing on the project reserves.

<b>Risk Control</b>	Response only if risk occurs.	Each project team has its own approach to risk control.	All projects continuously monitor risks, ongoing adjustments in measures.	Controlling system fully integrated with the corporate system.	A documented process using risk assessment and data on the current state of risk management helps in management decisions during project implementation.
<b>Risk Documentation</b>	Risks are not documented.	Historical data, inconsistent collection are considered.	Historical data, triggers of negative events, treasure for other projects are collected.	Project documentation is fully organizational.	Experiences from previous projects are captured and used to improve data collection. Evaluations are carried out after the end of the project.

## **Kerzner’s Project Management Maturity Model**

This model of maturity (KPMMM) is presented by its author as an extension of the CMMI model focused on project management. (Ferreira de Souza & Gomes, 2015) The resulting maturity of the organization is determined by the degree of integration of these elements within the organization. (Kerzner, 2001)

### Evaluation methodology and scale

The model is based on a tiered approach to assessing the maturity of the organization, distinguishing a total of 5 different levels. The model proposed by Harold Kerzner differs from the others by a different methodology for evaluating each level of maturity, with each level not evaluating the development of sub-processes or competencies, but monitoring individual aspects to match the profile of the organization at that level.

Unlike other used maturity models, Kerzner also considers the possibility of interweaving individual levels, where improvement does not always take place sequentially. As mentioned above, in addition to project management, this model, for example, works with TQM methods and the like. (Kerzner, 2001; Ferreira de Souza & Gomes, 2015)

Another difference compared to other (previously described) models is the fact that not every increase in the level of maturity of an organization is associated with increasing maturity and integration of specific processes. This is the first and fourth stages of maturity. Thus, none of these phases is associated with changes in normal business processes. (Kerzner, 2001)

### Risk management within KPMMM

Due to the different approach to the evaluation of each of the levels of maturity, in the case of this model, the evaluation of the maturity of the project risk management in the organization cannot be extrapolated from the partial results. It should be added, however, that the model works with a general methodology for risk management, and the level of development of the entire project management in the organization therefore depends on its level by analogy. However, the model introduced in 2001 does not fully reflect the current risk management methodology.

## **5 SUMMARY AND DISCUSSION**

In the previous section 4, the 4 most frequently used models of project management maturity were described and analysed in detail, in order to summarize the principles of how the evaluation takes place in the model and how the topic of project risk management is anchored in this model.

In Tab. 4, selected models are compared based on previously defined criteria. It is a qualitative evaluation of each aspect of the model regarding to use for project risk maturity assessment and improvement. From the point of view of comparative criteria, neither of the models is similar

to the other in more than two criteria. In Tab. 4, selected models are compared based on previously defined criteria. It is a qualitative evaluation of each aspect of the model regarding to use for project risk maturity assessment and improvement. From the point of view of comparative criteria, neither of the models is similar to the other in more than two criteria.

As the result shows, three of the four analysed models can be used as PRM maturity models. There is only exception in example of KPMMM, which, although based on the methodology of the CMMI model (Ferreira de Souza & Gomes, 2015), is unsuitable for further evaluation. Therefore, this model is excluded from further discussion.

Tab. 4 - Comparison of project risk maturity models. Source: own research

	<b>Definition of PRMM levels</b>	<b>Evaluation perspective</b>	<b>Approach of increasing the PRMM</b>	<b>The way of increasing PRMM</b>
CMMI-DEV	6 levels	PRM is evaluated as the whole process	Hybrid approach (Independently + throughout the system)	Expansion of activities in the process, integration into the whole
OPM3	5 levels	PRM is evaluated as the whole process + Model distinguishes partial PRM areas	Independently (but related best practices are necessary)	Expansion of activities
PMMM	5 levels	PRM is evaluated as the whole process + Model distinguishes partial PRM areas	Independently	Reactive approach, self-evaluation
KPMMM	Not possible to precisely define	Indirectly within the maturity of the organization	Indirectly within the whole	Reactive approach, self-evaluation

The first of the analysed characteristics is the possibility to create a specified evaluation scale for project risk management on the basis of the model, as expected property of each maturity model. (Crawford, 2014). In the case of the PMMM and OPM3 models, this is a 5-point scale. In the case of the CMMI model, it is a six-level evaluation, which according to Proença & Borbinha (2016) may not be entirely appropriate due to excessive granularity. In this respect, for example, the model from Irizar & Wynn (2018), which works with only 4 stages, is also not entirely suitable. According to Proença & Borbinha (2016), this scale does not allow organizations and projects to describe a sufficient number of steps of incremental improvement.

In order to be able to further improve the area of risk management, it is important to look at this area from the perspective of partial activities and competencies (second comparative criterion). In the case of the CMMI model, this area is viewed from the perspective of the entire PRM system, while in the OPM3 and PMMM models, specific activities and areas of competence can be deduced. According to the author of this paper, the second of these views is more appropriate if improvement is to be sufficiently targeted and to provide more suitable improvement. (Crawford, 2014, Project Management Institute, Inc., 2013) Despite some disadvantages, the CMMI model could be either used in this case.

The third monitored criterion has an impact on the improvement of PRM itself, which is based on the regularities and interconnectedness of models. For the three suitable models, each of them chooses a slightly different view. In the case of CMMI-DEV, maturity of PRM can be increased to some extent regardless of the remaining aspects of PM. In addition, the OPM3 model, with its interconnectedness of partial best practice, enforces a certain degree of interaction within the entire system while increasing maturity. In contrast, within the PMMM model, it is possible to increase the evaluation completely regardless of other project competencies (or areas) in the organization. Considering that projects do not take place in isolation but in the context of an organization (Cooke-Davies et al., 2009, Project Management Institute, 2013), it will also be necessary to consider the extent to which “advanced PRM” can perform its function properly if other aspects are insufficient. In this case, it seems advantageous to link this area at least to a minimum extent with the context of the whole project management

system. However, here the author is aware the fact that the model is always used with respect to the needs of the organization (Backlund et al., 2014), and therefore the PMMM model can be considered appropriate.

In the case of the last criterion, the principle of evaluation (and thus increasing) of PRM maturity in the organization is compared. The models can be divided into two categories - models that increase the maturity by the expansion of related activities (CMMI-DEV, OPM3) and models working on the principle of self-evaluation of quality of key aspects (PMMM, KPMMM). In this case, it is not possible to evaluate exactly which system is more advantageous. Rather, it is the illustration of principle of how the model is constructed.

In comparison with models specially designed for the field of PRM (section 0), the use of general models for the evaluation of PRM offers an advantage in the form of the possibility to expand (narrow) the range of considered project areas (knowledge areas, competences) according to needs. At the same time, the author of this paper points out that compared to specialized models, it is advantageous to evaluate certain project area (PRM) always in the context of the whole system. Further, partial use of models only for the required areas of project management can partially reduce the general shortcomings associated with evaluation, such as the cost of the entire asset or time. (Staples et al., 2007) On the other hand, such use does not make it possible to eliminate previously identified shortcoming associated with neglect of non-process factors. (Görög, 2016, Nicholas & Steyn, 2017)

## **6 CONCLUSION**

The aim of this work was to analyse PMMMs and evaluate their possibilities as a tool for evaluating the maturity of project risk management, when such an approach should be more effective.

For a closer analysis, the four most frequently used models were selected based on the previous research - CMMI, OPM3, PMMM and KPMMM. The evaluation frameworks of models were described, the levels of maturity and the system of assessment were introduced. At the same time, the role of risk management within the model was described, specifically the way in which this model considers the process and whether it is possible to extrapolate the maturity of this process from the results. Then, the chapter 5 dealt with the comparison of selected models and with the analysis of their suitability. The use of standard maturity models to evaluate the maturity of project risk management has proven to be a possible alternative to the specialized PRMMMs created so far (section 0).

The main contribution of this article is in expanding the base of maturity models to help improve project risk management in organizations. Although there is a further increase in the number of new maturity models specifically developed for certain purpose, this exploratory study uses the reverse process. Namely the use of proven maturity models for assessment and improvement of project sub-areas.

Although project management is a complex discipline, evaluation and adequate project risk management is one of its essential areas. The results of this work will find their application not only in the academic sphere, where PMMMs can also be viewed as models of evaluation of partial project areas. Given that the models are generally based on the principles of self-evaluation, the results of this work will find application in the managerial field. However, further research should be devoted to empirical confirmation based on the use in practice.

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# BLOCKCHAIN TECHNOLOGY PERSPECTIVES IN FOOD SUPPLY CHAIN

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## **Abstract**

The digital transformation penetrates different industries and sectors of an economy over the world and brings a wide set of technologies. Blockchain is an invention for which the implementation areas are not sufficiently researched out of the financial market. This paper addressed the potential of Blockchain usage in food logistic chains. The Blockchain technology is described in terms of its key characteristics, taxonomy, and potential benefits. Food logistic chains are described with their key characteristics. Particular emphasis is placed on the circulation of flows in the logistic chain (the accent set on an information flow mostly). The author's own contribution is the synthesis and design of the information framework based on Blockchain technology to the food logistic chains. In addition, here are described the examples where the Blockchain implementation could be profitable (e.g. traceability, commodity trade, control of origin, and quality of food). The main limitation of the research is the lack of data and information regarding the feasibility of such an implementation.

*Keywords:* blockchain, food, supply chain, digitalization, agriculture, information flow

## **1 INTRODUCTION**

The agriculture and food industry is a significant part of the world economic system. On the one hand, it is under increasing pressure from regulators, on the contrary, it is one of the most protected industries which supports sustainability in food sufficiency. Population growth, climate changes, and public awareness of the environmental impacts of the stuning sector are pushing the industry to implement new technologies and business models. Nowadays the development of the sector has influenced by increasing pressure from consumers, further harmonization in the regulation, and increasing sources of risks in supply chains (Dani, 2015; Iakovou et al., 2016; Nosratabadi, Mosavi & Lakner, 2020).

Like in a common supply chain, the food supply chain (FSC) can be defined as a chain of activities and participants (farmer, processor, distributor, retailer, etc) where each player contributes to increasing the added value of products on the way to the final consumer (Nosratabadi, Mosavi & Lakner, 2020). One of the differences is that the final product and the raw material both can be consumed by the final consumer (Kamble, Gunasekaran & Sharma, 2019).

Current challenges in the FSC focus on traceability, food safety, public health, the necessary certification systems, fraud, and counterfeiting, etc. Although the specific risk does not pose a threat to public health, consumer confidence in a brand and the reliability of the FSC can have negative consequences. In this situation, food integrity becomes a key point of the FSC. The main element in ensuring the integrity of systems is to increase the efficiency of working with information costs and the sharing of information among chain participants (Allen et al., 2019; Cole, Stevenson & Aitken, 2019; Ge et al., 2017).

There is a point of view that logistics companies on the one hand and manufacturers and retailers on the other are satisfied with the current state of the network and that the implementation of innovations is the result of pressure from consumers. The innovation process

in supply chain management often lies at the level of organizational changes related to business processes or business models. Although a particular innovation may be based on a current technological basis or a new disruptive technology, the main added value is created in the process changes (Manners-Bell & Lyon, 2019).

One of the state-of-art technology that has the potential in FSC is Blockchain. Success and awareness of Blockchain technology are associated with the cryptocurrency bitcoin and its creator Satoshi Nakamoto. A special type of decentralized distributed database was created for enabling trustworthy financial transactions without the use of a central authority (Nakamoto, 2008). However, this technology is constantly evolving and is now widely used in non-financial sectors - health, energy, charities, property management, science, retail, tourism, media, and government (Cole, Stevenson & Aitken, 2019; Swan, 2015). The main announced benefit of Blockchain is the creation of a transparent system that includes distributed, unchangeable and secure storage of transaction information (Allen et al., 2019; Hackius & Petersen, 2017).

The aim of the paper is to provide a basic overview of Blockchain technology and to place it in the context of the FSC. The technical nature of the Blockchain technology and the details of its implementation will not be intentionally examined in detail. The first part of the review is devoted to the principles and properties of Blockchain technology and its taxonomy. The second part analyses the issues of the trust and informational flow in the FSC. The third part contains a framework proposal for a model of the use of Blockchain technology in the FSC and examples of the use of Blockchain. The last part indicates the directions for future research and the limits of using the technology.

## **2 THEORETICAL BACKGROUND**

### **The outlook of Blockchain technology**

The term "Blockchain", depending on the context, can mean a data structure, algorithm, set of technologies, a set of distributed peer-to-peer systems with a common field of application or a computational paradigm compatible with a distributed economic system (Leng et al., 2018; Drescher, 2017). Moreover, there is a combination of technologies in Blockchain that have a considerable history in computer science: public/private key cryptography, cryptographic hash functions, distributed databases, consensus algorithms, and decentralized processing (Ge et al., 2017). The term "peer-to-peer" is used not only in computer science and means the direct sharing of objects of a tangible or intangible nature without intermediary points (Veber, 2018). Blockchain is referred to as a disruptive technology, and it is very often the case that it is the fifth computing paradigm following mainframes, PCs, the Internet, social networks, and mobile phones (Swan, 2015).

Blockchain is a type of distributed database for recording transactions, the contents of which are located on all computers in the relevant peer-to-peer network. Blockchain is also named as "Distributed ledger technology". Records in the database are linked sequences of blocks (a block is a digital image of a single transaction). Each block contains the timestamp of the transaction and is cryptographically secured (Seebacher & Schüritz, 2017).

Blockchain is based on the three important properties - decentralizing, verifying, and immutable. The decentralized peer-to-peer network does not need the participation of a central authority or central institution for establishing trust. Every member of the network keeps a local copy of the database on its computer. Each transaction is verified using a public/private key cryptography. Immutable means that after realizing a consensus algorithm the transaction information is added in a new block which will be added in the chain and this information cannot be changed (Hackius & Petersen, 2017, Kouhizadeh & Sarkis, 2018).

The specific technical implementation of Blockchain depends on many factors and the following points need to be determined when designing specific system architecture. First is a permission to the Blockchain. In terms of Blockchain typology, there is a basic division between public and private networks. For example, the bitcoin network is public, as it does not require any permission to participate in the network. In the case of the second, private Blockchains, participants usually know each other and have permission to work with the network from the 'validator'. The participants can be from different organizations, and their relationships can be governed informally or on contracts. There is also a third type of Blockchain - federated, which has the characteristics of both public and private Blockchain, only unlike private to verify transactions, only a predetermined group of network participants has the right (Casino, Dasaklis & Patsakis, 2019; Ge et al., 2017; Kamilaris, Fonts & Prenafeta-Boldú, 2019; Kouhizadeh & Sarkis, 2018).

The second issue is the consensus algorithm, i.e. how the new transaction block will be added to the chain. The most used algorithm is 'Proof of Work' which is used in cryptocurrency networks and is associated with high costs (mainly the energy costs required for computer performance, which is much criticized for this type of compliance due to environmental impacts). An alternative approach to consensus is called 'Proof of Stake'. In this case, different entities in the network, related to shares in the network, have different powers in approving transactions (Cole, Stevenson & Aitken, 2019; Kamilaris, Fonts & Prenafeta-Boldú, 2019).

Another taxonomy of Blockchain is associated with technology development. Three levels of Blockchain development can be defined: (a) Blockchain 1.0 - invention and development of cryptocurrencies, use of asymmetric cryptography; (b) Blockchain 2.0 - contracts management, development of economic and financial applications; and (c) Blockchain 3.0 - development outside the traditional economic and financial domains (Swan, 2015).

One of the directions of development and practical application of Blockchain in business practice is the so-called smart contracts. It can be presented as a contract in digital form (algorithms and codes), which is implemented according to predetermined fixed conditions and rules. The fulfilment of contractual obligations is checked automatically in the relevant Blockchain network. The result is increased efficiency and reduced costs and time required in business operations. An example could be the implementation of a documentary letter of credit with electronic verification of all necessary documents and without the need to order special services from the bank (Belu, 2019; Kouhizadeh & Sarkis, 2018). The Blockchain can be implemented as part of cyber-physical systems and be combined with the Internet of Things (IoT) devices. Also, Blockchain has a big opportunity in the precision agriculture context where information from the remote-control devices, monitoring devices, etc. is collected in the Blockchain (Allen et al., 2019; Antonucci et al., 2019).

### **Food Supply Chain**

Slack and Brandon-Jones (2018) define Supply Chain Management as the management of relationships and flows across operations and processes that contribute to creating value (products and services) for the end customer. The authors also point out that it is necessary to distinguish between the terms "supply chain" and "supply network". The latter can include hundreds of simple "supply chains" and can be characterized as the interconnection of a set of processes (Slack & Brandon-Jones, 2018).

In the transition from the general concept of the logistics chain to the FSC, it is necessary to define specific factors operating in the sector. In common, the agriculture and food industry is under the influence of a whole group of social, economic, technological, and legislative factors that affect the nature of the food logistics chain and subsequently the availability of food for

the end customer. Such factors include interventions by governmental and non-governmental institutions, including local authorities, the nature and characteristics of agricultural production and food, seasonality and the impact of climatic conditions, quality requirements, input variability, market selection, selection of logistics companies, storage, transport, security, recycling, capacity constraints, the need for traceability and visibility, etc. (Dani, 2015; Iakovou et al., 2016).

FSC can be divided into a so-called commodity or produced focused chains, which focus on commodity markets and consumer-driven chain. Commodities are trades in raw materials, which in most cases take place on futures exchanges. The business model is 'many sellers - few buyers' and the flow of information between participants is minimal. When focusing on the end customer, food traceability and quality come to the fore. Products that were previously traded on commodity exchanges (e.g. coffee) and now have increased added value also enter retail. It is important to realize that there are significant barriers to entry in this market for new players (certifications, standards, regulations, etc.), but they enter as regulators in monitoring and ensuring the quality of production. The business model is determined by many buyers and a smaller number of sellers (Dani, 2015).

In general concept, FSC can be viewed as a system with agricultural production there is an agricultural product transformed into a finished product with added value. Every part of the chain increases the added value and gain its additional profit. There are often cases of vertical integration in food chains, where the goal is a larger share of total revenues (Dani, 2015). Overall, the current FCSs face various problems, either the dominance of multinational corporations and holding companies, food waste, overuse of natural resources, etc. (Iakovou et al., 2016).

In common, FSC includes main and supporting processes, including plant and animal production, processing, testing, packaging, storage, transport, distribution, and marketing. The harmonization of processes in the chain supports five flows: material, information, process, financial, and the flow of energy and natural resources. It is necessary to emphasize that in the marked concept, apart from traditional players, other subjects can be divided into private and public. The first category may include farmers, research institutions, industry partners, transporters, financial institutions, etc. The second group is introduced by government agencies and international organizations whose activities and decisions influence the links in the chain and the value-added process (Iakovou et al., 2016).

Many actual problems in the FCS related to the information and its reliability: traceability, transparency, consumer trust, quality and food safety, environmental impact, etc. Ge et al. (2017) note that consumers are interested in information about the safety and sustainability of the food. However, in the current FCS, information about the product is collected in each stage of processing and supply and is distributed not in a transparent way. In the other hand, government regulation in the food industry requires the use of certification schemes and traceability of the beverages and goods. Currently, the information about the origin and specific properties of the product is stored by the third side, the authority. Particularly it can be on the paper, in another case in databases with different ways to access. Ge et al. (2017) mention that this way of information storage has problems with fraud, corruption, double-spend of certificate, etc. These and other problems have resulted in inadequate transparency in FSC (Ge et al., 2017; Abeyratne & Monfared, 2016). It should be emphasized that the problem of information asymmetry arises in the FSC when the participants in the chain not equally informed, and inefficient allocation of information can cause market failure (Antonucci et al., 2019).

Another challenge associated with the information flow in the FSC is transparency and the possibility to verify information on certain characteristics of goods or production conditions. For example, these may be Fairtrade or Organic standards and certificates, which are important tools for working with the customer and the source of added value in FSC. Verification of a specific product to meet certification standards is usually not easily available for the end customer. This reduces confidence in brands and can disappoint consumers due to fraud in the markets (Abeyratne & Monfared, 2016).

In addition to the concept of information flow, the issue of information costs arises (e.g. contract process, business partner searches, collected information about the characteristics and origin of goods as they move through supply chains). The FSC with the more complex structure has usually the higher information costs (Allen et al., 2019).

### **3 METHODOLOGY**

The methodological framework of the present study is based on a systematic analysis of Blockchain technology, which is evaluated through a fundamental analysis of the context. The aim is to identify the main directions of usability within the agri-food logistics chain. Conclusions are drawn from the analysis of available professional sources based on analytical-synthetic procedures. Based on the findings, an example of the digitization of the food supply chain is formulated, including the categorization of collected data. Approaches to food supply chains with a focus on the specifics of Blockchain technology are the theoretical anchoring of the researched issues. The greatest research uncertainty is the relative novelty of the topic. Most of the published articles have the character of review studies. Specific case studies and statistical data are available to a very limited extent. This area represents a possible direction for further research.

### **4 RESULTS**

As shown above, it is important for FSC how the information flow takes place within the chain. It may seem that automating the transfer of information is the only task for Blockchain implementation. However, in line with the concept of digitization, Blockchain can be seen as a platform for digital flow, in which records are kept not only of financial transactions but also of orders, stocks, data from technical equipment (IoT, RFID), online certificates, etc. Another advantage of using a Blockchain is the "single image" - participants in the chain can rely on trusted records that cannot be forged or deleted. This reduces transaction costs and increases intra-chain transparency (Lucena et al., 2018). The data from each operation is processed, stored, and becomes an unchanged record, which relies on the previous block and will itself be the basis for subsequent changes (Kamilaris, Fonts & Prenafeta-Boldú, 2019).

The author proposes to consider the transmission of information not as a stream from the producer to the final consumer, where all information cannot be available to each network participant or the costs of checking its reliability exceed the value-added from the products. The information flow can be considered as a "pool", in which information from each participant of the network flows and to which participants have access in accordance with access rights (Figure 1). It is seen that the consumer acts as a recipient of the information and only in some cases can send information to the system. For example, in the case of registration in the loyalty program.

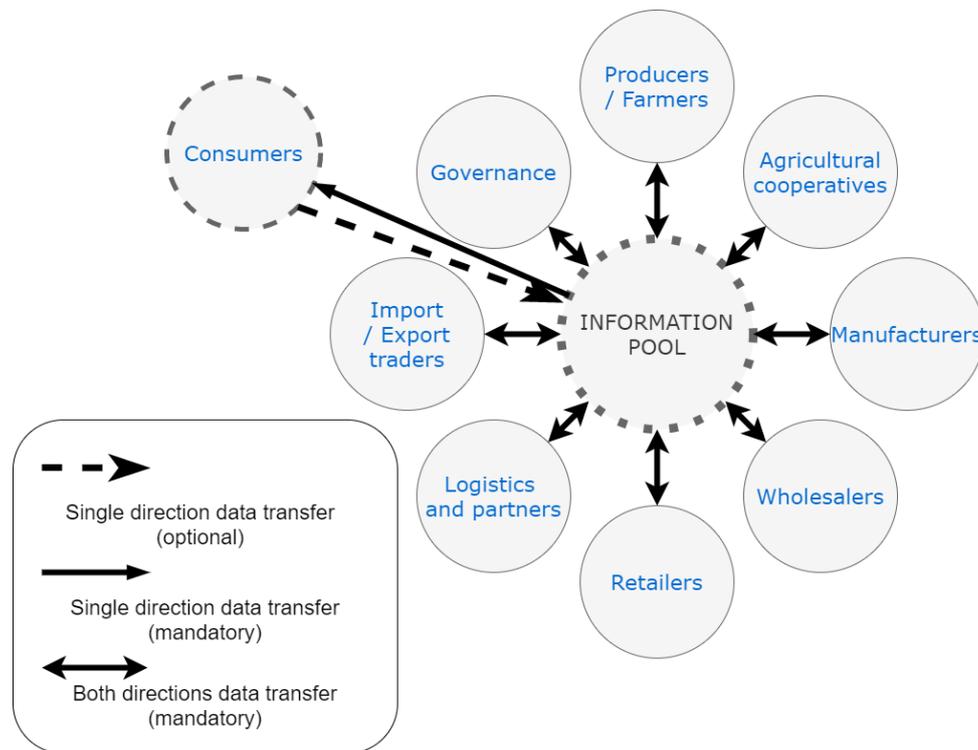


Fig. 1 – The model of information pool. Source: own research

There will be several types of roles in such a system: (a) Registrar - provide access to network participants and define roles; (b) Standards Organization - defines the rules of individual organizations and standards (e.g. Fairtrade); (c) Regulator - provides certification, ensures legislative conditions and rules of trade in certain goods; (d) Farmer, producer, distributor, wholesaler, retailer, etc. - enter the relevant information into the network and obtain information from other participants; and (e) Consumers - buy products and in some cases can enter data.

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The Blockchain has great potential in the trade in agricultural commodities. In January 2018, Louis Dreyfus Company, Shandong Bohi Industry Co., Ltd, ING, Societe Generale, and ABN Amro completed a pilot project of Blockchain operations. During the designated transaction, all operations were carried out, including securing financing, contractual management, and related logistics processes. The business operation involved the sale of soybeans from the USA to China. The created Blockchain protocol Easy Trading Connect made it possible to carry out all documentary proceedings in five times shorter than in the standard procedure. For example, manual checks and unnecessary duplication of tasks have been eliminated by using the use of traditional business documents in digitized form (contract, letter of credit, certificates) and automated data comparison (LDC, 2018).

Traceability and quality control are among the most current challenges for the food industry, where Blockchain technology can also be applied. For example, in Brazil, they solved the problem of monitoring the quality of cereals. Existing transport and storage processes often affect grain quality, causing damage and contamination. Grain quality control information is stored in electronic spreadsheets and then distributed among stakeholders without providing a

single version of the database. The Blockchain-based network within the group of Brazilian grain exporters GEBN helps to control the quality of grain at all stages of distribution (Lucena et al., 2018).

## **5 DISCUSSION**

The potential possibilities of Blockchain application in the logistics chain are extensive and not fully described - the emergence of new applications and each new implementation moves experts' knowledge of this technology forward. It is obvious that it is not possible to make an exhaustive analysis in one article and it was an outline of the issue.

The main shortcoming of many studies is that they do not highlight the limits and disadvantages of Blockchain technology. The lack of open data and feasibility studies does not allow for a probabilistic determination of which companies the implementation will benefit from, as reflected in the processes and then in the financial results, and whether such an investment is repayable. So far, these are questions that need to be answered. Also, a big shortcoming of Blockchain is the uncertainty in terms of legislation and the bad reputation of the cryptocurrency.

There are various frameworks that can help to determine if an organization needs a Blockchain or not. For example, the decision tree model helps determine whether an organization should deal with Blockchain or whether traditional database applications are sufficient (Lo et al., 2017). Another study shows that the use of Blockchain in the supply chain is rational if the organization plans to share information from a variable number of suppliers, partners, customers (Manners-Bell & Lyon, 2019).

However, there are potential directions in which research into the potential of the Blockchain may be of interest to both academia and industry. Food traceability and quality control have been and will be current topics and there is great potential in terms of applied research. Current history and pandemics also raise questions about what the agricultural and food logistics chains will look like in the future, how society will handle food shortages and self-sufficiency, etc. These are interesting questions for further research.

## **6 CONCLUSION**

The article is devoted to the potential of Blockchain technology in FSC. The principles of the Blockchain, its characteristics were analysed, and taxonomy was presented. The author of the article proposes to consider the information in FSC not as a flow from the producer to the consumer, but as a pool, where information from the whole chain is collected and each participant has access to certain information in accordance with access rights. Blockchain has application possibilities, however, detailed frameworks or guidelines have not yet been developed. The author sees this as an opportunity for future studies of the Blockchain potential for FSC.

### **Acknowledgement**

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# AN APPLICATION OF SPATIAL AUTOCORRELATION FOR MEASURING DISPARITIES OF THE TOURIST REGIONS IN THE SLOVAK REPUBLIC

*Jozef Gáll*

## **Abstract**

Although there has been an increase in the use of Exploratory Spatial Data Analysis (ESDA) in recent years, these analyses are still rarely used in the Slovak Republic. Spatial autocorrelation is suitable for analysing regional disparities, which were the core of this study. Regional disparities are a major problem in the development of the region, which means that the region cannot develop evenly. In this context, the tourism sector has also been experiencing long-term differentiation between the tourist regions. Models that include spatial dependence are more realistic and this kind of research in the field of tourism in the Slovak Republic has not been carried out yet, which is an original research. The main aim of this article is to analyse the spatial correlation of tourist regions and to identify disparities and allocated regions based on the homogeneity criterion using monitored indicators of tourism employment, number of arrivals and amount of tourism revenues in the tourist regions of the Slovak Republic. The spatial autocorrelation method will describe the presence (or absence) of spatial variations in the variable examined. In order to achieve the main aim, the local Moran's I index will be used as a local indicator of spatial association. This tool will then be calculated for each tourist region in order to reveal the degree of their spatial autocorrelation. The results of realized analyses are expressed graphically, through cartographic representation of spatial autocorrelation in modern statistical software. From the obtained data, "spatial clusters" and "spatial deviations" created by regions differing from their surroundings were identified by spatial autocorrelation with reference to the local Moran's I index and Moran Scatter Plot. The results of this study show that regional disparities cannot be rebutted. However, the tourism potential in the Slovak Republic, but also in individual tourist regions, that creates an opportunity to use it as a tool for solving (mitigating) regional disparities.

**Keywords:** *regional disparities, spatial autocorrelation, tourism employment, visitors' arrivals, tourism revenues*

## **1 INTRODUCTION**

In general, the shorter the distance between places in space, the more similar are their welfare or deficiency rates – a phenomenon called spatial autocorrelation. Although the concept of spatial autocorrelation can be considered a special case of correlation, it has its own meaning. While the correlation statistics were designed to show relationships between variables, spatial autocorrelation shows correlation within variables across geo-referenced space (Bahn, 2005).

Spatial autocorrelation is based on W. R. Tobler's first law, which says "...everything is related to everything else, but near things are more related than distant things." (Tobler, 1970, p. 236). Spatial autocorrelation expresses the existence of a dependency between variable values in adjacent areas or in a nearby location, or a systematic formula of variable values across locations on the map, based on common factors (Griffith & Chun, 2014). Getis (2008) states that in the 1990s, the area of spatial autocorrelation has matured to the point where the methods and concepts it has developed have become essential pillars for world's researchers in many disciplines, including ecology (Fortin, Dale & Ver Hoef, 2016), epidemiology (Auchincloss et

al., 2012), urbanism (Liu & Chen, 2007), geology (Pérez-Peña et al., 2009) and finally in the tourism sector (Stankov et al., 2017). The application of spatial autocorrelation in studies of Slovak researchers representing all social science disciplines (including tourism sector) is rarer. In the Slovak Republic, spatial autocorrelation was dealt with for example by Hlásny (2005), Kusendová and Solčianska (2005) or Rusnák and Lehocký (2016).

In this article, I will try to point out the differentiation of tourist regions in the Slovak Republic through the application of spatial autocorrelation. It is by using this method, whose application to the lowest local level of the municipality for which the statistical data analysed is monitored and consequently the conversion of results to the level of tourist regions (tourist regions in the Slovak Republic are not covered with administrative regions), one can point to certain distortions that can be tracked when analysing similar variables at the level of larger territorial units. The methodological procedures that will be applied in this paper represent a tool for monitoring the spatial-temporal aspects of the studied phenomena. This article offers a current picture of the division of tourist regions according to their significance into clusters using input indicators describing the situation in year 2020. This research can serve as a potential pillar in the concept of strategic documents relating to development and investments directed to tourism at regional level.

The liaison documents of this article will be scientific and research studies dealing with the issue of regional development by Micháľková and Kubičková (2019), Micháľková (2010), Bubelíny et al. (2019) and a territorial planning document of the Ministry of Economy of the Slovak Republic from year 2005 – Regionalization of Tourism in the Slovak Republic. This support tool is a comprehensive work of defining tourist regions into categories based on their appropriate preconditions for development, the importance and development priorities of each region. In the light of the fact that tourism is a dynamically evolving area, the question about the timeliness of the region's categorization, regional disparities and the entire document is emerging from the actual issue of the document. However, the aim of this article will not be to analyse the current situation, but to point out the regional differences in terms of sectoral structure regarding the tourism sector.

## **2 THEORETICAL BACKGROUND**

The development of regions and the related regional differentiation in the territory of the Slovak Republic has gradually become a priority topic not only for policy makers, but also for researchers examining regional disparities. A small country such as Slovakia did not initially register growing regional disparities. This has already resulted in the situation that the interest to dealing with this issue is coming, compared to other European Union countries a few years later. The continuous growth of regional disparities in the Slovak Republic was shaped by a strong regional contrast. Scientific research studies presented in a book dealing with regional disparities in Slovakia (Michálek & Podolák, 2014) point to unequal development not only in economic development, but also in the area of social development and social security. We can observe the existing gap between the living standards of urban (developed regions) and rural (less-developed regions) population.

Tourism is closely related to many economic sectors, such as agriculture, construction and retail, and therefore its development has the potential to create positive externalities for the rest of the economy. The development of tourism can also support the productivity of other sectors through industrial substitution and integration and lead to structural changes (Li et al., 2016). Based on the above-mentioned advantages, tourism has an important place in regional development and resource efficiency. Especially in eliminating regional disparities, tourism allows regions that do not have adequate resources and opportunities for development in

agriculture and industry but have a rich tourism offer to be able to develop in a balanced way in terms of tourism. However, the available literature on this topic brings two contradictory ideas (Li et al., 2016): (1) Tourism reduces regional inequality. Weak regions usually have an abundance of tourist attractions, which tend to distribute development outside industrial centres to the backward regions of the country. (2) Tourism expands regional inequality. The unequal distribution of tourism includes one or more major regions rich in tourism and a few less-developed tourist regions.

Michálek (2012) states that the interest in exploring spatial and regional disparities is growing. The main reason is their deepening and growing problems with possible development of less-developed regions in the future (Bubelíny, Kubina & Koman, 2019). The negative consequences may be more cost-effective as a preventive solution to the problems of less-developed regions (Matlovič & Matlovičová, 2011). An important question when examining and characterizing regional disparities is the choice of variables to assess the level of regional development. The most common indicators are employment and unemployment rates, gross domestic product level, average and real wages. In the context of tourism, the most appropriate indicators are those that reflect the contribution of tourism to the region (its growth and development as well as to society, nature and the environment). These variables do not exist in isolation from their surroundings and are therefore more or less influenced by it (Baggio, 2019). Given the essence of existence in the space, it is appropriate to apply spatial autocorrelation rather than traditional methods of analysis.

Spatial autocorrelation is a phenomenon whose essence is that variables at nearer locations may reach more similar values than variables at distant locations (Gregory et al., 2009). This may be due to similar natural conditions or as a result of the natural context of phenomena. It is in spatial autocorrelation that the values of variables in space are not random, but there is a spatial dependence between them. In conclusion, it is possible to distinguish the positive or negative link between the data. Positive autocorrelation is characterized by the creation of “spatial clusters” with similar values. In case of negative autocorrelation “spatial deviation” are created. Spatial autocorrelation is an important tool for evaluating dynamics and time changes in spatially ordered variables examined (Griffith, 1987).

As mentioned in the introductory part of this article, the issue of spatial autocorrelation has been addressed by several authors from the Slovak Republic. However, in conditions of tourism, this research is unique.

### **3 METHODOLOGY**

The main aim of this article is to analyse the spatial correlation of tourist regions and to identify disparities and allocated regions based on the homogeneity criterion using monitored indicators of tourism employment, number of arrivals and amount of tourism revenues in the tourist regions of the Slovak Republic.

In terms of researching regional disparities in tourist regions, it is appropriate to rely on the tools for exploratory spatial data analysis. From this perspective, I will deal with the measurement of spatial relations within the regional structure of the Slovak Republic. The estimated models will be applied to the tourist regions, which were defined in the document issued by the Ministry of Economy of the Slovak Republic in year 2005 – Regionalization of Tourism in the Slovak Republic. For the purposes of this article, data obtained from the database of the Statistical Office of the Slovak Republic (2019) – Employees by economic activity collected through workplace regarding the NACE I section will be aggregated to the local and regional level. The application of spatial autocorrelation, the interpretation of resulting models and subsequent visual comparison (via cartogram) is performed in modern statistical software

R and software for exploratory spatial analyses, including spatial autocorrelation analyses GeoDa.

The traditional exploratory data analysis survey data analysis (including the correlation statistical methods used to examine the relationship between variables) does not examine the explicit location component of the data set, but instead deals the relationship between variables and their mutual interaction. Exploratory Spatial Data Analysis (ESDA) correlates a specific variable to the location, considering the values of the same neighbourhood variable. The method used for this purpose is called spatial autocorrelation. Spatial autocorrelation describes the presence (or absence) of spatial variations in each variable. As with normal correlation methods, spatial autocorrelation has positive and negative values. A positive spatial autocorrelation is when variables close to each other have similar values (high or low). Negative spatial autocorrelation indicates that neighbouring variables will vary (low values beside high values). If there is no relationship between the values of variables located in space, the values are statistically insignificant (Anselin, Syabri & Kho, 2006).

Wilhelmsson (2002) describes three main tools of the ESDA – Global Indicators of Spatial Autocorrelation (GISA), local indicators and geo-statistical tools based on structural functions. The global spatial autocorrelation rate focuses on a single value for the entire study area. The local spatial autocorrelation rate detects variability and divergence of all values in the studied area, which leads to better interpretation of its spatial variability. The known global spatial autocorrelation rates are Moran's I index and Geary's C index and local spatial autocorrelation rates are Local Indicators of Spatial Association (LISA). Anselin (1995) in his study notes that Moran's I index including global indicators and local indicators spatial association Moran's I index are commonly applied to the study of spatial autocorrelation. In order to achieve the main aim of this article, the local Moran's I index is used as a local indicator of spatial association. This tool will then be calculated for each tourist region in order to reveal the degree of their spatial autocorrelation. The local Moran's I index is calculated based on a mathematical relationship (Anselin, 1995):

$$I_i = z_i \sum_j w_{ij} z_j \quad (1)$$

where

$I_i$  ...local Moran's I index of spatial unit  $i$

$z_i / z_j$  ...average deviation

$w_{ij}$  ...spatial weighting function

Negative value of the local Moran's I index represents cumulation of different values of variables and positive value of the local Moran's I index cumulation of similar values of variables (high or low) in the studied area, while talking about "spatial cluster" or "spatial deviation" (Lalor & Zhang, 2001). In the context of the resulting values of the local Moran's I index, the correlation obtained can be divided into five levels based on its degree of dependence – "very weak" (0.01 – 0.19), "weak" (0.20 – 0.39), "medium" (0.40 – 0.59), "strong" (0.60 – 0.79) and "very strong" (0.80 – 1); a value of 1 showing a perfect correlation (Maths & Stats Support Centre, 2016). The LISA cluster analysis results can be categorized into four groups – Moran Scatter Plot's Quadrants (Spurná, 2006). The Moran Scatter Plot interpreted in the research section of this article (see Figure 2, Figure 4 and Figure 6) illustrates the relationship between the original values of the variable at each location (horizontal X-axis) and the average value of the same variable in adjacent units (vertical Y-axis). It is very important to consider each Quadrant of Moran Scatter Plot. In the right upper Quadrant I. are "spatial clusters" whose variable value is higher than the total average value. Similarly, in the left lower Quadrant III.

are "spatial deviation" whose value of the variable is less than the total average value. These results confirm a positive spatial autocorrelation. Results in the other two Quadrants (II. and IV.) indicate a negative spatial autocorrelation. The advantage of the LISA cluster analysis application is the calculation of the local Moran's I index and the visual representation of cluster and semantic maps (Kouba, 2007).

## 4 RESULTS

In the following part of the present article I identify the tourist regions through spatial autocorrelation. The application of this statistical method will create models that diversify regions into the group of "developed regions" and "less developed regions" (in terms of tourism).

In order to identify the spatial neighbours, at the beginning of the observation, the first-order Queen's contiguity has been constructed. The Queen's contiguity spatial weighting includes all areas j adjacent to the area i on the edges and peaks (nodal points) (Anselin, 1995). This spatial weighting matrix is applied to all variables examined. The neighbourhood structure is illustrated by a histogram (Figure 1) constructed by a first-order Queen's contiguity.

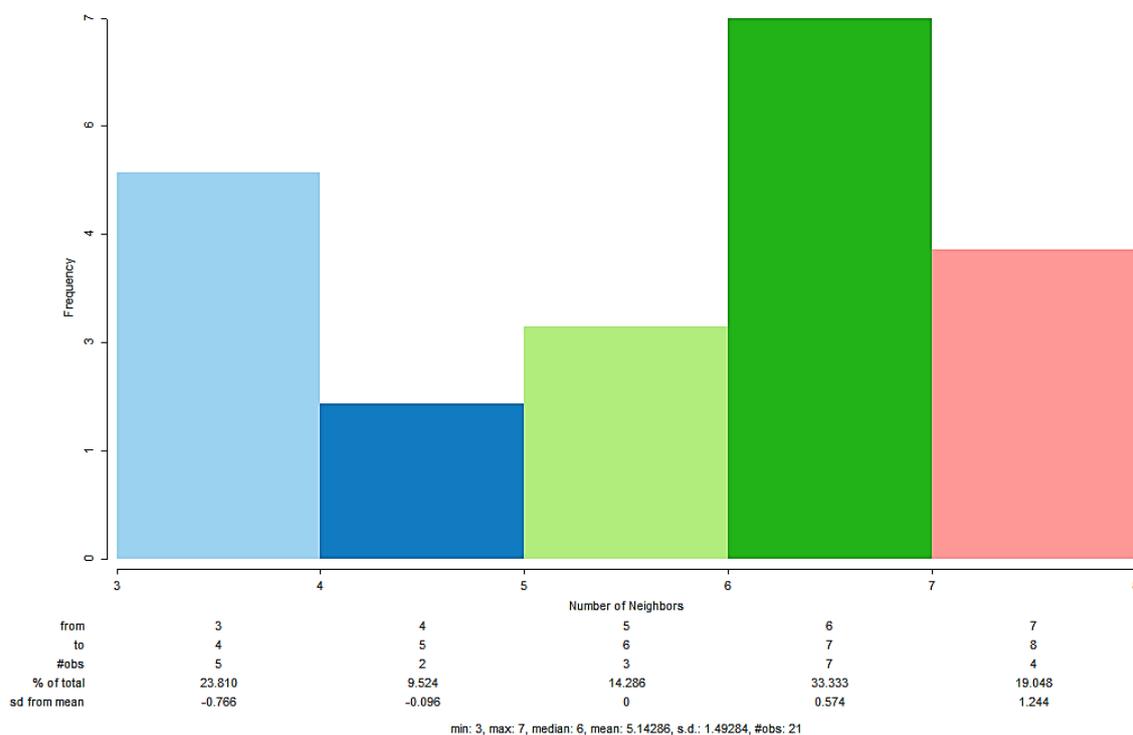


Fig. 1 – The neighbourhood structure of the tourist regions in the Slovak Republic. Source: own research according to data by Statistical Office of the Slovak Republic (2019)

It can be seen from the histogram that five tourist regions have a common border with three regions. Two regions are surrounded by four tourist regions. Three regions of all neighbours with five. The seven regions, which represents the largest quantity within the structure shown, have six neighbours. And the largest number of neighbouring regions (seven) have four tourist regions.

The local Moran's I index statistics have been calculated in the same way for all variables examined which will be used in the analysis. The statistical significance of the calculated values of the individual variables, which rejects the null hypothesis that there is no spatial autocorrelation, will be verified using the permutation procedure. These random permutation

procedures are performed to recalculate the statistics many times and generate a pseudo-significant level of significance (Anselin, 1995). For each local Moran's I index statistics was carried out 999 random permutations. All values of the individual variables through local Moran's I index are of a significant level 1% as statistically significant.

The first variable examined in the article is tourism employment. The tourism (a sector in some countries), which has a close relationship with job creation (directly and indirectly) and economic growth, is currently seen as a precursor to inclusive growth (Kubičková, Micháľková & Fodranová, 2017). It is the potential of tourism in job creation that confirms this statement. The statistics published by the World Bank Group (2020) show that, in terms of the overall contribution of tourism to employment in the Slovak Republic, 6.23% of all jobs were created in year 2018, representing 159.69 thousand job opportunities.

The spatial autocorrelation of tourism employment in the regions had a positive value of the local Moran's I index ( $I = 0.319$ ), which means that in relation to the variable studied, high values are concentrated near high values and vice versa, low values are concentrated near low values, which can be seen in Figure 2. Spatial dependence on its correlation scale is characterized by a weak degree. The tourist regions belonging to Quadrant I. are the region of Bratislava, Central Považie, Lower Považie and Upper Považie. These regions are ranked in the highest category, which means that they have a high concentration of tourism employment. Other regions that belong to Quadrant II. (Záhorie, Upper Nitra, region of Nitra, Šariš and region of Košice), most of the regions concentrated in Quadrant III. and the regions Pohronie, Liptov and Tatras located in Quadrant IV., are clusters with lower observation values compared to Quadrant I. and therefore can be classified as regions with a low or rare spatial concentration of tourism employment in the Slovak Republic.

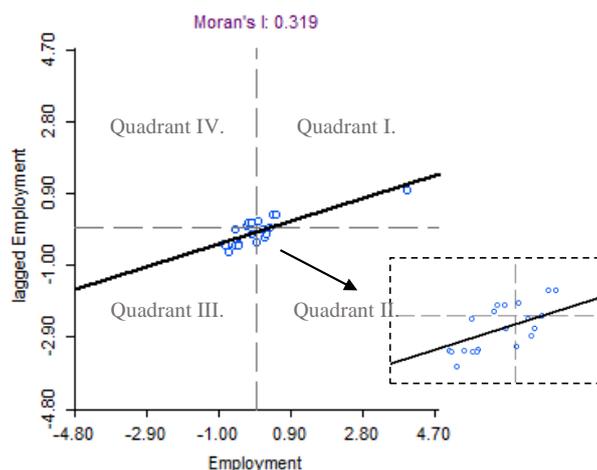


Fig. 2 – Local Moran's I index and Moran Scatter Plot of tourism employment in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

The results of the LISA cluster analysis in Figure 3 show in detail the regions of the Slovak Republic in which similar above-average and/or below-average values are created. The cluster of high values represents region of Bratislava, which is the only one characterized by high spatial autocorrelation, while Danubeland, Turiec, Orava, Poiplie, Gemer, Spiš, Upper Zemplín and Lower Zemplín are identified as a cluster with low spatial autocorrelation. Tatras have created a separate cluster – low-high spatial autocorrelation. This cluster can be explained by the fact that in the region there are districts with low employment, which are surrounded by districts with high tourism employment. The results of other tourist regions were statistically insignificant. Based on the findings with reference to the local Moran's I index and the Moran Scatter Plot (Figure 2), it can be concluded that the core of tourism employment is the region

of Bratislava. Looking at the map is a clear lag of regions in the southern and eastern part of the Slovak Republic.

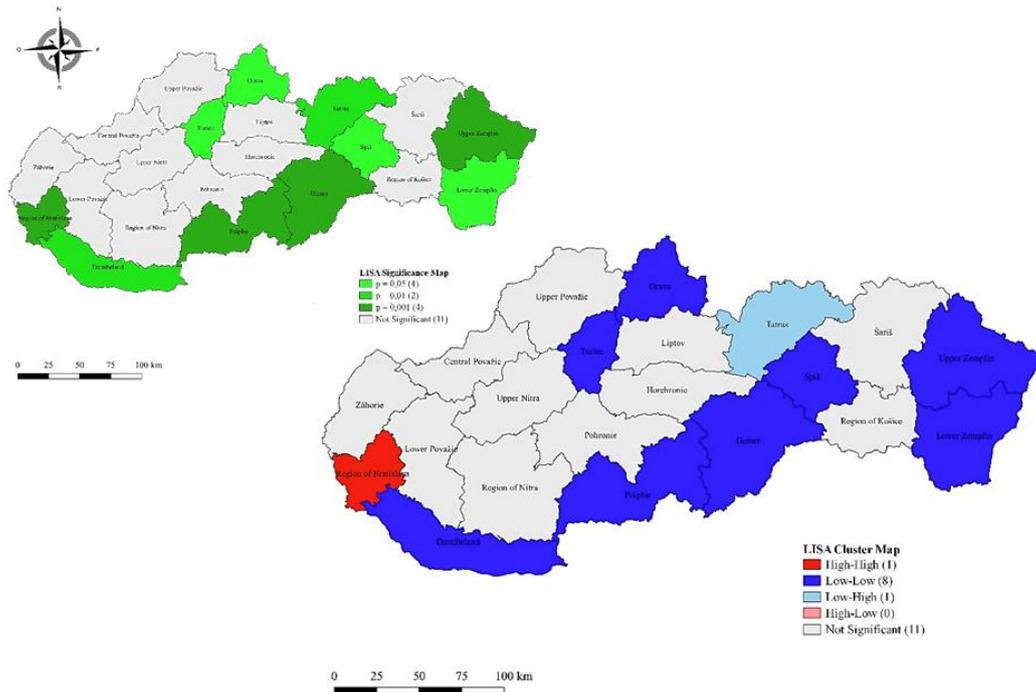


Fig. 3 – LISA clusters map of tourism employment in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

The second variable examined that will be statistically analysed is the number of arrivals in the tourist regions. Regions (especially mass visited) and interest destinations benefit from tourism in many ways. For example, regular audience minimizes negative seasonality factors. The higher the number of visitors arriving in the region, the greater the expansion of the supply environment and at the same time the other sectors of the economy are prospering. Finally, the influx of visitors is the basis for infrastructure development, the quality of which directly affects the local population (Goeldner & Ritchie, 2014). According to data published by the Ministry of Transport and Construction of the Slovak Republic (2020) in year 2019 the Slovak Republic visited 6.43 million visitors, of which 2.47 million visitors was from abroad, which represents the greatest number of arrivals ever.

The results of spatial autocorrelation with the analysis of the local Moran's I index in the case of arrivals to tourist regions reached  $I = 0.523$ . As the value is positive (as in the previous variable – tourism employment), it means that the regions show positive spatial autocorrelation and spatial clusters arise. This value ranges between 0.40 – 0.59 and can be described as the medium value of spatial dependence. On the Moran Scatter Plot (Figure 4), most regions are concentrated in Quadrant III. Exceptions are region of Bratislava, Liptov and Tatras located in Quadrant I., region of Nitra and Upper Považie in Quadrant II. and Central Považie in Quadrant IV. In these clusters, the neighbourhood is created by high values surrounding high values, low values surrounding high and vice versa, high values surrounded by low values of the number of arrivals in the tourist regions.

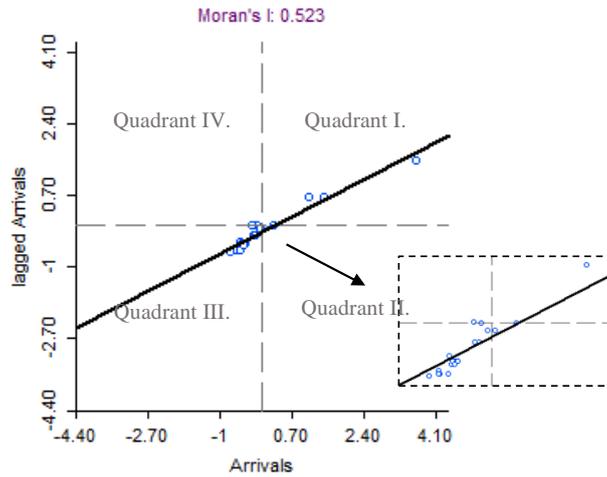


Fig. 4 – Local Moran's I index and Moran Scatter Plot of arrivals in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

The results of spatial autocorrelation in Figure 5 illustrate the location of clusters with the level of visit rate in regions of the Slovak Republic. Regions included in the cluster with a high number of arrivals are region of Bratislava, Liptov and Tatras. These results are supported by the fact that these regions have long been one of the most visited destinations in the Slovak Republic (Statistical Office of the Slovak Republic, 2018). The paradox is Orava, which according to statistics is among the most visited destinations and as a result of spatial autocorrelation is in a cluster – low-low spatial autocorrelation. The same cluster includes Turiec, Horehronie, Gemer, Spiš, Upper Zemplín and Lower Zemplín. In Quadrant II., where the category – high-low was evaluated by Upper Považie. The Quadrant IV., that is low-high, was assigned to Central Považie. The remaining nine tourist regions evaluated the software as statistically insignificant.

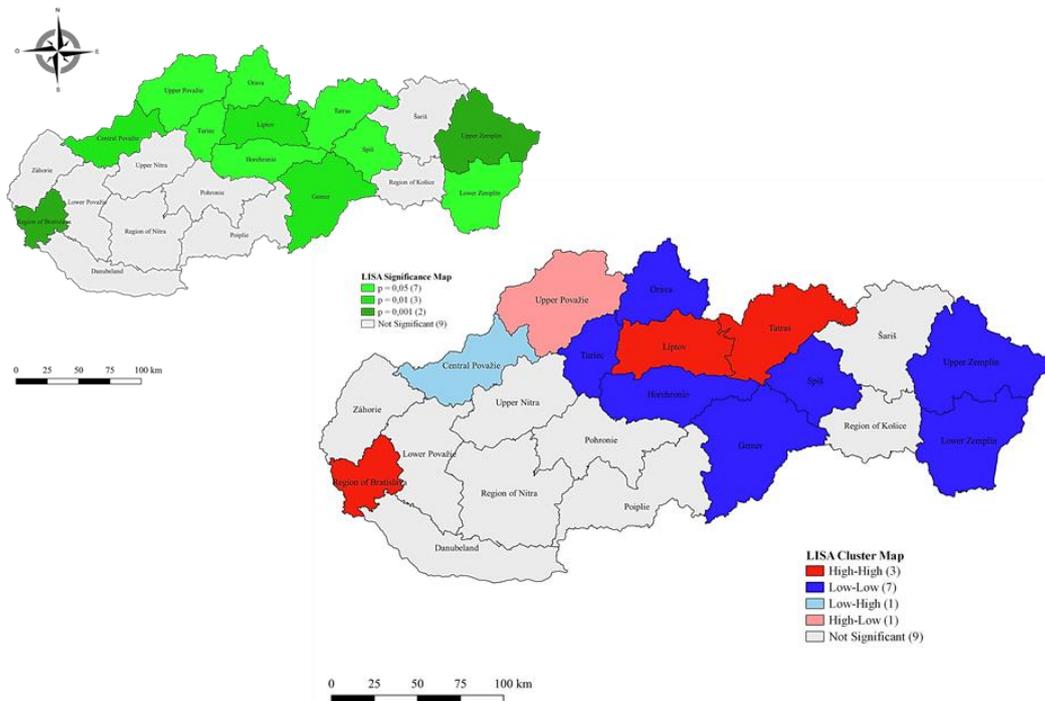


Fig. 5 – LISA clusters map of arrivals in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

The last variable examined was the tourism revenues, which I consider to be a suitable (and previous results) follow-up indicator of regional disparities identification. The arrivals of visitors in the region provide a lot of income to the local economy. Visitors spend money on accommodation services, meals (especially catering services and the purchase of food and beverages) and transport (including buying tickets or renting a car). Finally, they invest money for activities related to sports, recreation and shopping (e.g. souvenirs and alcohol). This aspect of tourism, together with job creation, plays an important role in regional development and improving the quality of life (Goeldner & Ritchie, 2014). Revenues from active tourism in year 2019 amounted to EUR 2,897.82 million (World Bank Group, 2020).

The spatial concentration index of tourism revenues, which was analysed using the local Moran's I index and interpreted by the Moran Scatter Plot, reached  $I = 0.590$ . Based on the results of the analysis of statistics, this is a medium degree of spatial dependence. The Moran Scatter Plot categorizes the results into two Quadrants. In Quadrant I. correlate the region of Bratislava, Central Považie, Lower Považie, Upper Považie, Liptov and Tatras. The remaining tourist regions were in Quadrant III. The results of the analysis in both cases confirmed positive spatial autocorrelation.

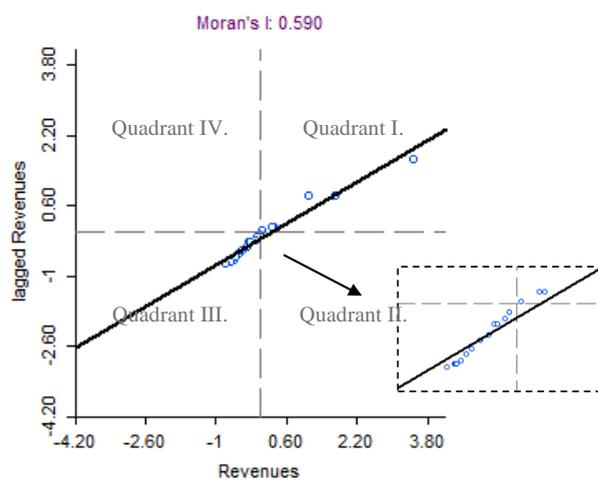


Fig. 6 Local Moran's I index and Moran Scatter Plot of tourism revenues in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

Spatial autocorrelation of tourism revenues, as evidenced by the results of the LISA cluster analysis in Figure 7, suggests that there are four regions belonging to a cluster of high values. In contrast to the local Moran's I index results shown in the previous Moran Scatter Plot (Figure 6), the regions of Central Považie and Upper Považie have become statistically insignificant. The same is true for the second cluster of low values, in which seven regions are located and the remaining eight (as well as Quadrant III.) have become statistically insignificant.

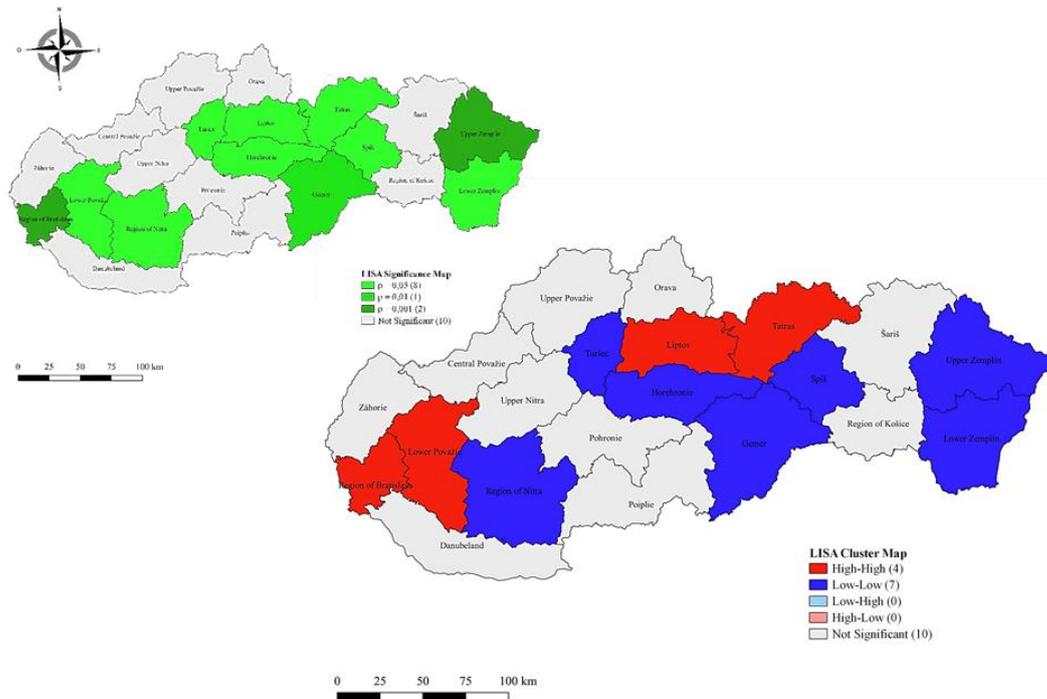


Fig. 7 – LISA clusters map of tourism revenues in tourist regions of the Slovak Republic (2019). Source: own research according to data by Statistical Office of the Slovak Republic (2019)

## 5 DISCUSSION AND CONCLUSION

Among the indicators of economic development and based on OECD statistics data from year 2018, the Slovak Republic belonged to the countries with the largest regional disparities within the European Union countries. This fact can also be transferred to the tourism sector, which has been recording the existing differentiation between tourist regions in the long term. The breakdown of the country's territory into areas (later regions) and demonstration of their disparities in the context of tourism was brought by the document – Regionalization of Tourism in year 1962, which is the predecessor of the territorial planning document for tourism development – Regionalization of Tourism in the Slovak Republic from year 2005 (Kmeco, 2016).

Although the use of ESDA has increased in recent years, these analyses are still rarely used in the Slovak Republic. Spatial autocorrelation is suitable for analysing regional differences, which were the main substance of this study. Clusters created by tourist regions that differ from their surroundings were identified from the data obtained by LISA cluster analysis with reference to the local Moran's I index and Moran Scatter Plot.

The results of this study highlighted significant mutual correlations between the studied tourist regions, which may stimulate a discussion about the current consequences and further development of tourism in the conditions of the Slovak Republic. The analysis was successful from a theoretical but also a practical point of view – identification of developed “functional” tourist regions and the possibility of their conceptualization; obtaining useful information for practitioners related to the location and construction of new tourism infrastructure in the regions or for policy makers in terms of further promoting and developing tourism destinations.

Looking at tourism employment, regions in the southern and eastern part of the Slovak Republic are lagging behind. On the opposite side are the regions of western Slovakia. Tatras, whose low employment values in tourism are surrounded by high values, have been categorized into a

separate cluster. These results replicate the national employment trend in other sectors of the national economy across the Slovak Republic. The results of the spatial autocorrelation of the second examined variable in part replicate the attractiveness of the tourist regions, which encourages tourists to visit them. The high visit rate of region of Bratislava is conditioned by the presence of the capital, which is an ideal destination for all segments of visitors. Liptov and Tatras are situated in the Tatra Mountains and the Low Tatras. The results of the regions Orava and Horehronie are questionable, as both regions have many natural and cultural monuments and statistically are among the most visited destinations (Statistical Office of the Slovak Republic, 2018). The inequality of tourism revenues spatial autocorrelation has been evaluated into two clusters. Higher tourism revenues were recorded in the region of Bratislava, Lower Považie, Liptov and Tatras. By contrast, the region of Nitra, Turiec, Horehronie, Gemer, Spiš, Upper Zemplín and Lower Zemplín were identified as a cluster with low levels of tourism revenues. When observing the results of the LISA cluster analysis for the variables examined – the number of arrivals and the amount of tourism revenues in the tourist regions of the Slovak Republic, the similarity of clusters can be observed. This phenomenon is due to the logical link between the two variables, as the increase in revenues is mainly influenced by the number of arrivals to the tourist regions.

It should be noted that tourism is a cross-cutting sector that includes all companies with direct or indirect benefits from tourism. Considering that this research included an analysis from the statistics for NACE I section – Accommodation and food service activities and certain economic activities in tourism, such as transport, travel agency activities, travel agency reservation services and related activities, create a larger component of market share and have a higher consumer profile, the final share in the case of the employment and revenue indicator may have significantly higher values.

The results of this study show that regional disparities cannot be rebutted. The question is how to deal with this problem and try to straighten them. Goeldner and Ritchie (2014) describe the importance of tourism in terms of its benefits to the landscape, economy, industry, culture and society, people and even the environment. Tourism contributes not only to greater economic activity but creates more jobs, revenues and plays an important role in (regional) development. The tourism potential in the Slovak Republic, but also in individual tourist regions, that creates an opportunity to use it as a tool for solving (mitigating) regional disparities.

The presented research can be considered as the first step of a large-scale survey focusing on spatial contexts in selected tourist regions. With the help of the identified clusters, it is possible to carry out further research using a wider range of indicators characterizing the development of tourism. Part of the future research will point out the internal features and possibilities of the formation of tourism clusters. In this context, the calculated local Moran's index and their visual representation of cluster and semantic maps are considered to be useful tools for identifying local spatial groupings and for assessing the impact of regions by corresponding global statistics. The second positive aspect of the research is the application of modern tools of artificial intelligence in the conditions of tourism.

### **Acknowledgement**

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# MARKETING ON SOCIAL MEDIA AND CONSUMER INVOLVEMENT IN DESIGN PROCESS

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## **Abstract**

Social media is one of the best opportunities to a brand to connect with consumer. Increasingly social media has evolved into a space that serves the needs of businesses – everything from advertising, to brand-consumer engagement and ecommerce sales. Consumers are no longer passive, but they have chance to be involved in design process and they can participate in design process anywhere and anytime. The aim of the paper is to find out consumer use of social media and involvement in design process as a part of marketing. The primary data was obtained by using the standardized query method. Descriptive statistics and cross-tabulations were used to process the results from the questionnaire. Purchases on social networks are typical for women. Most of respondents who work during their studies also shop through social networks. Respondents who buy through social networks are more often involved in product decisions. For consumers is important to have opportunities to have chance to express their opinion and to guide sellers to customize theirs offers and as a result, respondents become more important and significant. The ability to customize products would make the offer more interesting or fill the under-supply of some products. Consumer involvement in design process or consumer opportunity to decide about products can be effective marketing tool on social networks.

*Keywords: social media, design process, participatory design, consumer, customized products*

## **1 INTRODUCTION**

Social Media, today, is among the ‘best opportunities available’ to a brand for connecting with prospective consumers. Social media is the medium to socialize. These new media win the trust of consumers by connecting with them at a deeper level (Neti, 2011).

Increasingly social media has evolved into a space that serves the needs of businesses – everything from advertising, to brand-consumer engagement and ecommerce sales. At present, 38% of internet users follow their favourite brands on social media, with 25% following brands they are thinking of buying something from. And survey from Global Web Index shows that 28% of internet users discover brands via ads seen on social media, 25% of internet users discover brands via recommendations/comments on social media, 42% of internet users use social networks to research products, 17% of internet users clicked on a sponsored post on Instagram, 22% of internet user are motivated to purchase by lots of likes/good comments on social media and 12% of internet users are motivated to purchase by a “buy” button (Lanteri, 2019).

In 2019, was number of people using the social media 3.534 billion, and mobile social media users was 3.463 billion, and in both cases, numbers rise by 7.8% (Kemp, 2019). In 2018, according to Mastercard Advisors, consumers spent a record \$853 billion dollars, with ecommerce sales achieving the most significant growth rate in over a decade – 18% year-on-year (Lanteri, 2019).

Wang, Malthouse and Krishnamurthi (2015) note that as shoppers become more comfortable with their mobile device, even typically low-spending buyers increased their order rate and size for all items purchased. Schultz and Block (2015) also establish that the ratio of purchased

goods to researched goods is much higher for online shopping than it is for in store shopping, meaning customers are more likely to place an order online rather than in-store after the same amount of research.

Many companies simply connect with consumers as part of a marketing strategy, but social media engagement is increasingly impacting all business areas, in particular new product development. In the analysis stage, designers can use crowdsourcing to engage consumers in product strategy development, market research. In the creation phase, it can range from initial ideas to choosing a solution concept. In the definition phase, it can involve more qualified participants through open innovation platforms, while the implementation phase is enabled by digital production technologies that facilitate home production, customization (De Vere, 2014).

The designer's commitment to consumer involvement in product creation is partly a measure of how much autonomy the consumer has in making decisions, but also of how much autonomy the designer consciously 'hands over' to the consumer. Customized products allow the user considerable freedom in decision making about a product's functionality, its appearance and the tools and methods used to customize it. Nonetheless, such decisions are taken in spite of the designer's vision, rather than as a result of his/her intent. Thus, customized products exhibit a high degree of consumer involvement, but a very low degree of designer's commitment. This can be contrasted with opened design products, where the designer must make a deliberate decision, not only to allow the consumer to change the product, but to help the user to do so, either by providing the tools or by supplying the product in an easy-to-modify format (Sinclair & Campbell, 2014).

Recent research studies (Mitchell et al., 2015, Trischler et al. 2018) suggests that designers create more innovative concepts and ideas when working within a co-design environment with others than they do when creating ideas on their own.

## **2 LITERATURE REVIEW**

### **Social media as part of marketing communication**

Marketing is a well-developed methodological science and is constantly changing its rules according to the needs and developments taking place in and around it. To establish itself in the new era, it has begun adapting the new methods of virtues to come to terms with the new paradigms of business. The role of marketing in the development of business is intact but the way it was executed is radically changing due to contributions made by satellite communication and extensively developed scientific devices. Social Media is best defined in the context of the previous industrial media paradigm. New web technology has made it simple for anyone to create and most highly, issue their own content (Saravanakumar & SuganthaLakshmi, 2012).

One of the advantages of internet is that it enables businesses to reach a worldwide customer population, so that customers can survey, select, and purchase products and services from businesses around the world (Al Kailani & Kumar, 2011). Indeed, online social networks have profoundly changed the propagation of information by making it incredibly easy to share and digest information (Akrimi & Khemakhem, 2012). Social media is "a group of internet-based applications that builds on the ideological and technological foundations of Web 2.0, and it allows the creation and exchange of user-generated content". Social media has many advantages as it helps connect businesses to consumers, develop relationships and foster those relationships in a timely manner and at a low cost (Kaplan & Haenlein, 2010).

Social media marketing represents such a major cost-effective opportunity for marketers who wish to start a dialogue with their customers and get an insight into their likes and dislikes.

Social network services such as Facebook, Instagram, Youtube, and Twitter, and others, aggregate an abundance of information. This information has a great potential for marketers and online marketing campaigns. Also, the most important aspect of social media and its impact on marketing is the possibility to collaborate and co-create products and campaigns with consumers. By reaching engaged consumers, online marketers can significantly improve an organization's profitability, revenue streams, and increase the loyalty of customers who may become brand advocates in online settings (Opreane & Vinerean, 2015).

The increasing number of user devices, as well as the link of the online and offline space, create a new type of user - the user omnia. The customer omnichannel behaviour model assumes that the customer will interact with the company by using multiple channels and devices before a purchase (Dorman 2013). Juaneda-Ayens et al. (2016) refer to these users as 3.0 users. According to them, in the omnichannel space, marketing channels and devices are used without problems and freely exchange, which makes it difficult for businesses to control the purchase process of their customers. Edelman and Singer (2016) say that analysing and customizing a customer journey to these users is important in providing relevant experience during each step of the buying process for brand interaction.

The increase in social network users allows sellers to use them to reach their customers. But it is not just about building a customer relationship, but also about getting necessary information in a faster and easier way, and also involving customers in the product design process. This gives the customer the opportunity to participate in the decision-making process, to customize the products, and become more important.

### **Consumer involvement in design process**

Participatory Design is a design methodology in which the future design users participate as co-designers in the design process. Participatory design is considered – to be both a process and a strategy – which brings end-users and customers to design process (Cipan, 2019). Participatory design is an approach to design that invites all stakeholders (e.g. customers, employees, partners, citizens, consumers) into the design process as a means of better understanding, meeting, and sometimes pre-empting their needs (Elizarova et al., 2017). Involving the user in the creation process implies developing solutions that are more durable and meaningful for the consumer (Knošková, 2014). It is a value-centered design approach because of its commitment to the democratic and collective shaping of a better future. For some, it is seen as taking away responsibility for design and innovation from designers.

Current state of the Web 2.0 makes it easier to take end users as co-designers by using online tools. Everyone can participate in the design process anywhere and anytime. Online tools lower the threshold to invite users into the different phases of innovation process as a daily practice. Online community also serves as a permanent connection to the users during the more silent phases of the process and enable constant forum for discussion and feedback (Näkki et al., 2008).

The more phases (Conception, Specification, Design and Manufacture) that a consumer is able to influence, the higher the degree of overall involvement; thus, open design products represent a high degree of involvement because the consumer has the possibility to exert influence in all four phases. Secondly, consumer involvement is also measured by the effectiveness of the consumer's influence, i.e. the extent to which their needs and opinions affect the creation of the product. Bespoke products, for example, allow the customer to influence only two phases: specification and design. Many bespoke products reflect this limitation and are only slight variations of a standard product, perhaps made in a unique colour or material, or incorporating an engraved logo (Sinclair & Campbell, 2014).

### 3 METHODOLOGY

The aim of the paper is to find out consumer use of social media and involvement in design process as a part of marketing. Primary and secondary data were used to achieve this goal. As a primary data were used various Slovak and foreign data from scientific databases, case studies, statistical data.

The primary survey was conducted using the standardized query method. The survey sample was 100 students from the University of Economics in Bratislava. The questionnaire was distributed via the Internet. The questionnaire consisted of 22 questions, including 5 selective questions, 8 dichotomous questions, 5 open questions, 1 semi-open questions and 3 simple questions.

For evaluating primary data obtained from our survey we used descriptive statistics. It allowed us to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. The results are also presented in tables and graphs.

Cross-tabulations were used to determine the different perceptions of participatory design between different consumer segments according to their behaviour. A crosstabulation is a joint frequency distribution of cases based on two or more categorical variables. Displaying a distribution of cases by their values on two or more variables is known as contingency table analysis. The joint frequency distribution can be analysed with the chi-square statistic to determine whether the variables are statistically independent or if they are associated. (Michael, 2001).

### 4 RESULTS AND DISCUSSION

A total of 100 respondents participated in the survey. Of the total number of respondents 65% were women and 35% men. Most respondents (24%) were 23 years old, followed by 20 years old (18%), 19 years old (15%), 21 years old (13%), 22 years old (13%), 24 years old (8%), 25 years old (6%) and 26 years old (3%). The survey examined whether students work during their studies. This question was answered by 96 respondents, 69.8% of respondents work during the study and 30.2% do not work.

In the survey we wanted to find out how respondents spend their leisure time (Fig. 1). Most respondents (83) spend their time with family and with friends. Sport is a favourite activity for 59 respondents. 45 respondents spend their free time listening to music, attending concerts and festivals and 42 respondents walking to nature. Leisure time activities has not impact on the use of social media or involvement in design process.

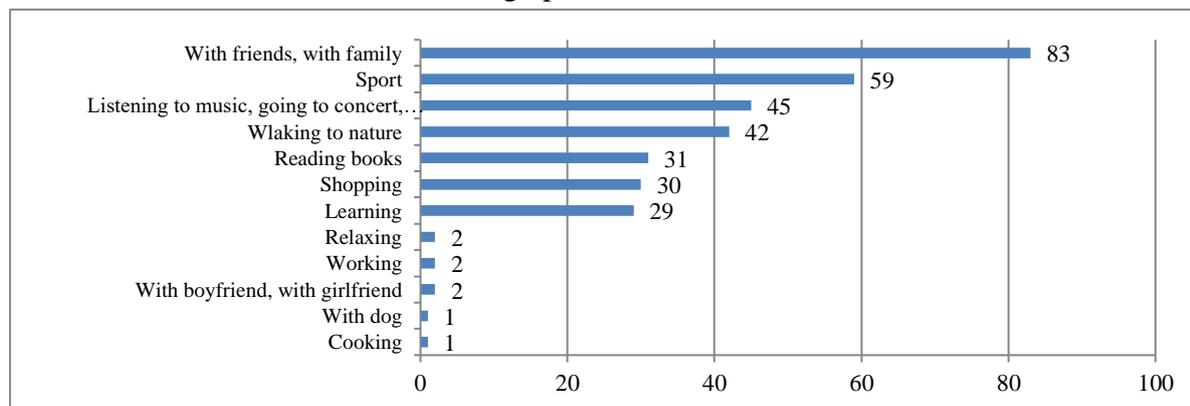


Fig. 1 – Leisure time activities of respondents. Source: own research

99% of respondents are users of social networks, only 1% of respondents are not. This fact agrees with the increasing number of users of social networks. The survey was focused only on students - young people, who are more likely to use benefits from the up-to-date technologies and that fact may distort data.

The most used social network is Facebook, used by 98 (99%) of respondents who used social networks. Instagram is second most used social network and it is used by 90 (90.9%) of respondents, the third most used network is LinkedIn, used by 18 (18.2%) of respondents. Respondents also use less known social networks such as Twitch, V: Live, Wicker, Telegram, Weverse Tumblr Vlive (Fig. 2). The world most used social platform is Facebook with number of users 2.449 billion of people. Instagram used 1 billion people (Kemp, 2020).

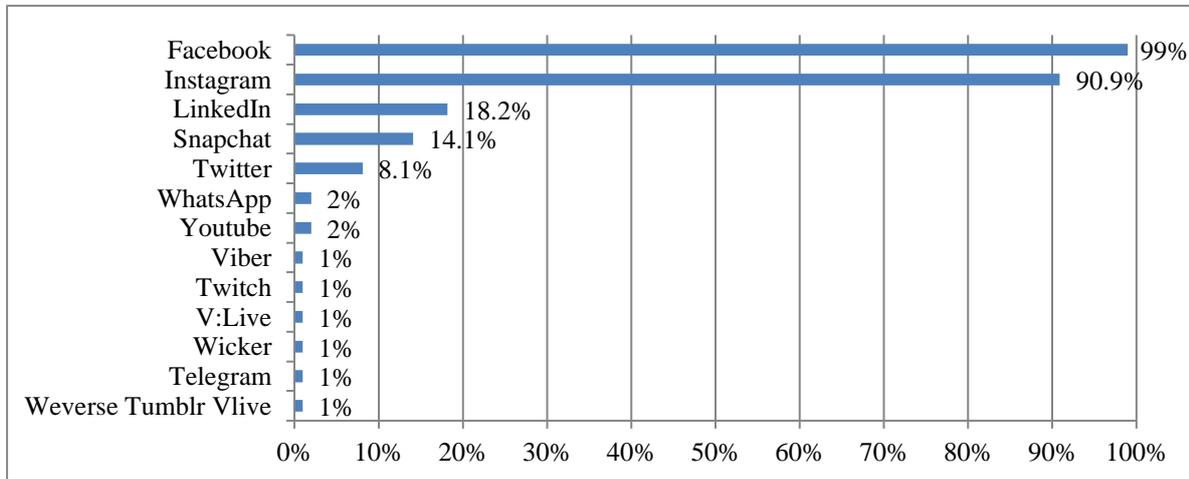


Fig. 2 – Social Networks in use. Source: own research

Most respondents spend 2-3 hours on social networks daily, 34 (34.3%) of respondents. 26 (26.3%) respondents spend 1-2 hours on social networks a day and 24 (24.2%) respondents 3-4 hours a day. 4-5 hours spend on social networks 8 (8.1%) of respondents, 5 hours and more spend on social networks 4 (4%) of respondents and less than 1 hour 3 (3%) of respondents. However, the time spend on social networks may differ from respondents' responses, because some respondents may not realize how much time they spend on social networks or they are reluctant to admit that the time spend on social networks is much higher than they stated. Kemp (2020) says that the average global internet user now spends 6 hours and 43 minutes online each day. That is 3 minutes less than this time last year. On social networks global average user spent 2 hours and 24 minutes daily.

32 (31.3%) of respondents purchase through social networks and 68 (68.7%) of respondents do not (Fig. 3). Hurwitz (2020) conclude that 55% of online shoppers made a purchase through a social media channel in 2018 and 70% of consumers look to Instagram for product discovery. During their studies, 66 (69.5%) students work and 29 (30.5%) do not work. Our results show that almost all students who shop through social networks, work during their studies (24 students which represents 82.7%), while those who do not shop through social networks work much less, only 42 (63.6%) work and 24 (36.4%) do not work ( $p < 0.06$ ).

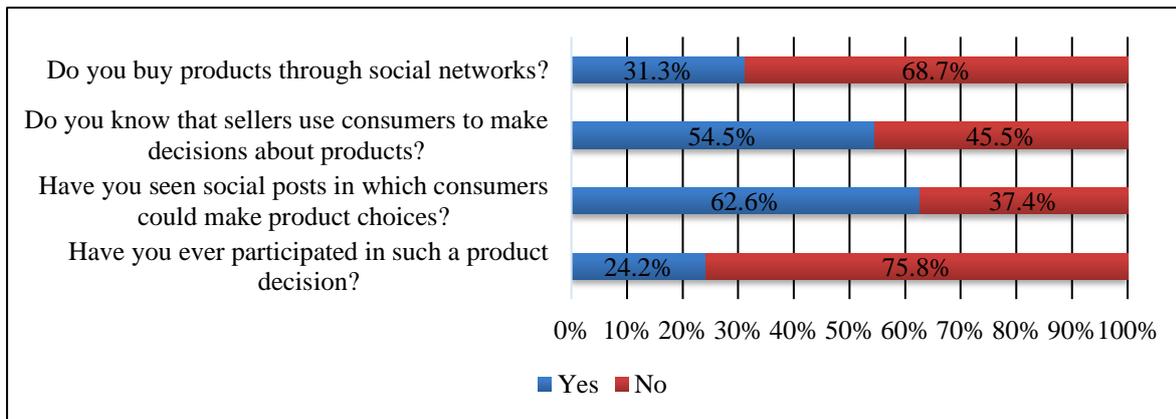


Fig. 3 – Knowledge of consumer involvement in the design process. Source: own research

54 (54.5%) of respondents were aware of that sellers use consumers to make decisions about products, for example by choosing between 2 product variants, and 46 (45.5%) of respondents were not. On social networks, 62 (62.6%) of respondents saw such types of posts and 24 (24.2%) of respondents participated in the decision-making process (Fig. 3). Respondents who were involved in making decisions about products by means of social networks most often decided about these products: clothing, shoes, cosmetics - hair shampoos, creams. Data from Statista (2020) says that most of respondents (57%) buy online clothes, then shoes (47%) of respondents, consumer electronics (40%) of respondents, books, movies, music and games (36%) of respondents, cosmetics and body care (32%) of respondents, bags and accessories (29%) of respondents. For online sellers or brands can be great to let consumer decide about products because consumers want to decide about the most purchased products.

Buying products through social networks depends from gender (Tab. 1). 31.3% of all respondents shop through social networks. We found out with statistical relevancy that much more women (39.1%) than men (17.1%) purchase products through social networks, with p-value < 0.5. Women represent 80.6% of shoppers through social networks. Another personal characteristics or leisure time activities of respondents do not have impact on purchases through social networks.

Tab. 1 – Crosstabulation Purchase through social networks against Gender. Source: own research

Cross-tabulation of Purchase through social networks (rows) against Gender (columns)

	[Women]	[Men]	TOT.
[Yes]	25	6	31
[No]	39	29	68
TOTAL	64	35	99

Pearson chi-square test = 5,05452 (1 df, p-value = 0,0245618)

Participation in product decision making depends from purchase through social networks (Tab. 2). If respondents make purchases through social networks, they also participate in product decisions in much higher extend (48.4%) than respondents, who do not shop through social networks (13.2%), with p-value < 0.0002. 62.5% of those who participate in product decision making also buy through social networks. We can say that respondents who buy products through social networks use more opportunities to influence the offer that they buy.

Tab. 2 – Crosstabulation Purchase through social networks against Participation in product decision making.

Source: own research

Cross-tabulation of Purchase through social networks (rows) against Participation in product decision making (columns)

	[Yes]	[No]	TOT.
[Yes]	15	16	31
[No]	9	59	68
TOTAL	24	75	99

Pearson chi-square test = 14,3261 (1 df, p-value = 0,000153717)

53 (53.5%) of the respondents would like to have more opportunities to participate in the decision-making about products, only 12 (12.1%) of the respondents do not want it and 34 (34.3%) of respondents do not know (Fig. 4)

79 (79.8%) of respondents like that they can be a co-creator of the products, and 20 (20.2%) of respondents do not like it (Fig. 4). Based on the answers from the respondents to the question of why they like to be co-creators of the products, we found out several facts. For consumers is important to be able to express their opinion and to guide the sellers in their product offer and to personalize the offer for consumers. Respondents become more important and significant through personalized products. Thanks to the possibility to customize the product, the offer would become more interesting for consumers. Customization of some products can fill insufficient offer. Respondents who do not like being co-creators of the products say that they have no interest to be co-creators, do not have time to do it, or that the retailer has to know what to sell to consumers.

38 (38.4%) of respondents already had the opportunity to customize the product, and 61 (61.6%) of respondents did not have this opportunity (Fig. 4). Respondents who had the opportunity to customize and then buy this product, most frequently customized these products: sneakers, clothes - dresses, wedding dresses, sweatshirts, t-shirts, socks, sportswear. Respondents also customized laptops, computers, and cosmetics.

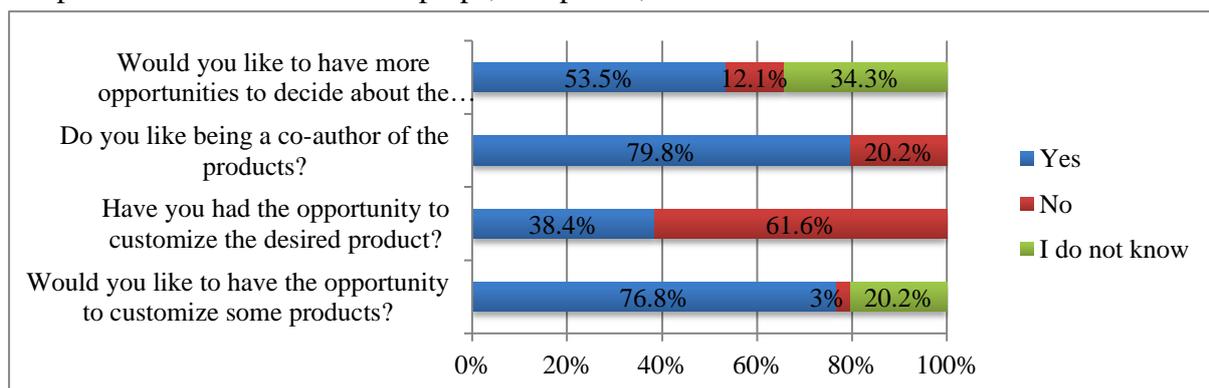


Fig. 4 – Consumers' involvement in the design process. Source: Own research

76 (76.8%) of respondents would like to have the opportunity to customize products according to their ideas, 20 (20.2%) of respondents do not (Fig. 4). Of those who shop through social networks it was 28 (90.3%) would welcome this option and of those who do not shop through social networks, 48 (70.5%) would welcome this option, which is significantly lower percentage as the one obtained for shoppers at a  $p < 0.07$  significance level. At the same time 18 (26.4%) of non-shoppers would probably take the opportunity to customize products. Products that the respondents would like to customize are clothing, shoes, accessories, jewelry, handbags, furniture, electronics - mobiles, laptops, computers and others.

## 5 CONCLUSION

The aim of the paper was to find out consumer use of social media and involvement in design process as a part of marketing. 99% of respondents are users of social networks. The most three used social networks are Facebook, Instagram and LinkedIn. The most respondents spend on social network 2 – 3 hours daily but real time spend on social networks can be different.

On social networks, 62 (62.6%) of respondents saw the social networks posts in which they could decide about products and 24 (24.2%) of respondents participated in this decision. Respondents who were involved in making decisions on social network most often decided about clothing, shoes, cosmetics - hair shampoos, creams.

Purchases on social networks are typical for women. Most of respondents who work during their studies also shop through social networks. Respondents who buy through social networks are more often involved in product decisions. They want to have more control over products which they buy.

For consumers is important to have opportunities to express their opinion and to guide sellers to customize their offers and as a result, respondents become more important and significant. The ability to customize products would make the offer more interesting or fill the under-supply of some products.

Consumer involvement in design process or consumer opportunity to decide about products can be effective marketing tool on social networks. Brands or sellers can get information about their consumers, their needs, and preferences. This information can lead to better marketing communication, targeting advertising or consumer segmentation.

### Acknowledgement

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# THE IMPACT OF GDPR ON MARKETING AND PROTECTION OF CUSTOMERS' PERSONAL DATA

*Lenka Hanáková*

## **Abstract**

In May 2020, it was two years since the European Data Protection Regulation (hereafter referred to as GDPR) came into force. Marketing activities and personal data of customers represent one of those areas that have been significantly affected by GDPR. The paper aims to find out how SMEs currently perceive GDPR, its implementation, subsequent provision of compliance and how do they assess the impacts of GDPR on marketing and protection of customers' personal data. A focus group method was chosen to obtain qualitative data. The purpose was to gain the views and experiences of participants from their more than two years of practice related to the implementation of the GDPR and ensuring subsequent compliance. Micro-enterprises, small and medium-sized enterprises were evenly represented. The results of the focus group will contribute to the specification, expansion or narrowing of problem areas. The results will be used for the formulation of some questions of the planned semi-structured interview, which will be the next step of future qualitative research. The results showed that GDPR is still a topical issue for SMEs that they have to address. The GDPR is perceived as a concern and another administrative and financial burden. The human factor is mentioned as the most common possible risk. The prevailing opinion on GDPR is the negative impact on business entities. The results also showed agreement on the existence of an impact on personal data policy.

*Keywords: GDPR, marketing, personal data, business entity, protection of personal data*

## **1 INTRODUCTION**

The personal data of every natural person means a very important commodity in today's technically advanced world for a number of entities. Business entities pursue the objective of targeting their marketing activities as accurately as possible in relation to existing or potential clients. That is understandable because all marketing activities mean financial expenditure for business entities. The aim pursued is therefore obvious – not only the return on funds spent on marketing activities, but especially the sale of products or services, i.e. retaining existing customers and gaining new ones. Personal data of individuals is essential for such a targeted focus. However, it should be borne in mind that the GDPR Regulation does not give business entities precise guidance on how to ensure their marketing activities are GDPR compliant. The rules contained in the GDPR apply to all entities that process personal data. These are generally established rules that must be respected by both state institutions and business entities. For example, business entities process the personal data not only of their employees but also of their customers or suppliers. However, it must be borne in mind that each business entity is different. This difference may lie, for example, in its size. It may be a small, medium or large business entity. Consequently, not only the scale, size and nature of its marketing activities, but also – and this is essential – its financial background can be derived from this. Responding to the requirements imposed by the GDPR and taking all necessary technical, organisational, or other measures to comply with the GDPR may be problematic or much more burdensome for some, especially small and medium-sized, business entities than for a large business entity that has completely different financial resources and background at its disposal. Recital 13 of GDPR clearly states that the specific situation of micro, small and medium-sized enterprises should be

considered. For this reason, there is a GDPR exemption for organisations with fewer than 250 employees relating to data retention. At the same time, it is explicitly stipulated that Union institutions and bodies, Member States and their supervisory authorities are to consider the specific needs of micro, small and medium-sized enterprises in applying the GDPR Regulation. The used term micro and small and medium-sized enterprises should be based on Article 2 of the Annex to Commission Recommendation 2003/361/ES1.

Recital 78 of GDPR explicitly mentions the need to take appropriate technical and organisational measures. This is considered necessary to ensure compliance with the requirements of the GDPR Regulation. The controller should be able to demonstrate compliance with the GDPR. The question is in what way. In this context, the Recital 78 of the GDPR mentions the need to adopt such internal concepts and the need to introduce such measures, which comply in particular with the principles of data protection by design and data protection by default. At the same time, possible examples are given, such as minimising the processing of personal data, pseudonymization of personal data, transparency, the opportunity of data subjects to monitor the processing of personal data and also the opportunity of controllers to create and improve security features. The Recital 78 of the GDPR is followed by Article 25 of the GDPR on data protection by design and by default. This Article lays down an obligation for the controller to introduce appropriate technical and organisational measures. This obligation concerns both the time of determination of the means of processing and the time of procession of personal data. When implementing the mentioned technical and organisational measures, the controller should consider, for example, the state of the art, the cost of implementation, the nature, scope, context and purpose of the processing. He should also consider the likelihood and severity of the various potential risks to the rights and freedoms of individuals.

It is therefore clear that the necessary technical and organisational measures must be introduced by all entities processing personal data of individuals. The GDPR Regulation does not distinguish whether the controller is in a position of a small, medium-sized or large business entity. The general assumption is that even small and medium-sized business entities can carry out risky and extensive processing of personal data, so they must also comply with the strict requirements laid down by the GDPR. Simply put, the GDPR regulates the scope of the obligations according to the parameters of the processing carried out. In other words, neither the number of employees nor the size of the business entity is decisive for the scope of the duties. The deciding factor in this regard is the riskiness and scale of the processing carried out by the business entity.

Obviously, the digital age brings with it many possibilities. Business entities are aware of the value of personal data of existing and potential customers. Due to technical progress, it is relatively easy to collect personal data of individuals and then use it for various purposes. The GDPR can therefore be seen as a fairly clear response from legislators to protecting the privacy of individuals. As reported by Kotler and Keller (2016), business entities constantly strive to improve customer relationships, focus on gaining and retaining customers and satisfying their individual needs. They also point out that the loss of profitable customers can have a significant effect on profits, while adding that there are large differences in the cost of maintaining current customer's satisfaction and the cost of acquiring a new customer. Specifically, it is estimated that the cost of acquiring a new customer is up to five times higher.

Marketing managers and business entities in general can now, about two years after the entry into force of the GDPR, assess not only the impact of this legislation on their activities and business, but also whether and how their perception of GDPR has changed compared to when it was not yet effective and was carried out by business entities implementation into processes.

The structure of the article is as follows. Firstly, a basic literature review and theoretical background is performed. Secondly, the methodology is explained. Thirdly, the results are presented. Finally, a conclusion is given. The author considers it important to emphasize that with regard to the breadth of GDPR issues and the limitation of the scope of this contribution, it was necessary to limit the focus group to only a few selected topics for discussion. The results of the focus group will contribute to the specification, expansion or narrowing of problem areas. The results will be used to formulate the questions of the planned semi-structured interview, which will be the next step of future qualitative research. It is also planned to use the results of the focus group for the preparation of a questionnaire, which will be carried out in future quantitative research.

## **2 THEORETICAL BACKGROUND**

### **Direct marketing**

The area of marketing represents one of the areas on which the GDPR Regulation has a major impact. Nevertheless, there is the explicit mention of marketing in the GDPR only in few places. Specifically, for example, in Article 21 paragraph 2 and 3 of the GDPR. In the event of the processing of personal data for direct marketing purposes, it is expressly provided for the right of the data subject to object at any time to such processing involving him or her. At the same time, it is expressly stated that any objection raised against the processing of personal data also includes implemented profiling in relation to this direct marketing. Paragraph 3 of this article then literally states: “Where the data subject objects to processing for direct marketing purposes, the personal data shall no longer be processed for such purposes”. This Article 21 already has its basis in the Recital 70 of the GDPR. The various parts of the Recital essentially express the basic ideas on which the GDPR Regulation and its individual articles rest. In this particular case then the following idea. If business entities process individuals’ personal data for direct marketing purposes, then there should be a right of the data subject to object to such processing, including profiling, free of charge and at any time – to the extent in that it relates to the direct marketing. It can be both initial and further processing. The business entity also has an obligation to explicitly alert the data subject to the existence of this right. Moreover, certainly for greater protection of the data subject, there is a GDPR requirement how to implement this obligation. Specifically – information on the existence of this right must be made clearly and separately from any other information. The fundamental idea regarding direct marketing is also contained in Recital 47 of GDPR – “The processing of personal data for direct marketing purposes may be regarded as carried out for a legitimate interest”. At the beginning this idea caused a great deal of uncertainty and misunderstanding from business entities. In particular, whether or not consent from the data subject needs to be obtained for direct marketing purposes. Because, according to Recital 47 of the GDPR, the processing of personal data for direct marketing purposes can be considered as processing carried out for reasons of legitimate interest. So, it could also be understood that there was no need to procure consent. On the above there is an effort to show that the provisions of the GDPR, whether its articles or Recital, are not always unambiguous and can open up space for different interpretations and understanding. After all – because of this the GDPR is often criticized. However – business entities had to implement GDPR. To do so, and in order that the implementation from their side was in order, they had to understand GDPR’s demands placed on them well. As mentioned above, the GDPR does not impose fewer requirements on small and medium-sized entrepreneurs. The deciding factor in this regard is the riskiness and scale of the processing carried out by the business entity.

## Literature review and selected theoretical starting points

Compliance with the GDPR must be carried out by all business entities that work with personal data of individuals and process it for different purposes, in our case for marketing activities.

As Srpová and Řehoř (2010) point out; marketing in small business entities differs from marketing in large ones. Small business entities are typically characterised by limited financial resources. The existence of this fact is why small business entities place great emphasis on the effectiveness of the funds spent and their return. The authors cite not only limited financial resources as a disadvantage to small business entities in terms of marketing, but also a lack of staff resources and a lack of theoretical knowledge and practical experience. These other two disadvantages of small business entities are also linked to limited financial resources. For a small business entity to be able to have an employee who will specialise exclusively in marketing, it means to be able to pay for this at the same time.

Martíšková, Humlerová and Štensová (2017) state that the estimated time required for GDPR preparation and implementation is in the range of 2 to 24 months, with generally 12 months for small and medium-sized business entities. The authors also point to research carried out by the Association of Small and Medium-sized Enterprises and Traders of the Czech Republic, which was carried out in June 2017. According to this research, business entities planned to implement, in particular, staff training and updating internal directives in the context of the GDPR Regulation. This research also showed, among other things, that small and medium-sized business entities routinely handle customers' or partners' data, for example, because of business offers, evaluation of cooperation with business partners or improvement of product offerings. The authors analysed the views of the business public on the GDPR privacy arrangements. The analysis was carried out while the GDPR was in force, but was not yet effective. However, there have been numerous discussions and evaluations regarding the practical impacts of the GDPR. Among the frequent views were, for example, that the GDPR represents a targeted liquidation of SMEs, precisely because of the high fines, and the need to create new job position (e.g. DPO) or that the GDPR creates opportunities for lawyers, consultants, cloud providers, etc., who seize the opportunity to offer tailor-made solutions to business entities not familiar with GDPR issues. The analysis carried out resulted, for example, in the following findings: (a) ignorance of the issue of GDPR by future stakeholders, (b) assessment of the GDPR Regulation as not entirely clear legislation, which is often vague and unintelligible, and (c) fear of increasing the bureaucratic burden for business entities.

Bandyopadhyay and Bandyopadhyay (2018) address key GDPR provisions and the main challenges that business entities have to face to comply with this Regulation. These challenges are seen in both technological and financial area, especially for small and medium-sized businesses, for business entities using blockchain technology, but also for business entities located outside the EU. The authors argue that compliance with the GDPR will have a substantial impact on the competitiveness of business entities that work with the personal data of EU citizens. The authors concluded that the continued competitiveness of business entities would depend on how they cope in practice with these challenges posed on them by the GDPR. Based on their findings and the knowledge discussed in the article, they argue, among other things, that many business entities will not be realistically able to achieve full compliance with the GDPR by the set deadline, i.e. by 25 May 2018. As a result, some competitive disadvantages can be found on the part of such business entities. This is that until they are fully compliant with the GDPR, there is a risk and threat of major financial sanctions for them. Last but not least, the existence of a competitive advantage for large business entities compared to small and medium-sized business entities is noted, considering the existence of the costs required for the introduction of the GDPR and full compliance with it.

Menon (2019) is of the opinion that there will be a data policy reassessment by marketing managers as a result of the GDPR. He therefore addresses some aspects of GDPR and its implications for marketing staff. He also draws attention to the fact that the GDPR makes no distinction between paid and unpaid transactions or between the use of different devices and technologies. He admits that one can expect marketing managers to test legislative boundaries and find ways to make only the necessary changes that don't overly disrupt their usual ways of operating. He also points to numerous analyses according to which marketing namely data-based marketing can be expected to have to undergo changes, but GDPR does not mean extinction for this area.

Schweigert and Geyer-Schulz (2019) address issues of the impact of GDPR on the design and measurement of marketing activities. They stress the importance of designing marketing and CRM campaigns in such a way that they correspond with the customer's requirements. They therefore consider the use of feedback and knowledge of previous campaigns as a good way to gather the information that are necessary for a creation of a targeted campaign. As they explain, the data and their collection are important precisely because they allow marketing managers to target their marketing and CRM activities more accurately. They seek to show how complicated data-relating activities are, i.e. processing them, collecting them, storing them after GDPR came into effect. At the same time, however, the authors point out that GDPR has not only downside. They also perceive and mention the positive side of this legislative act. It is primarily about the benefit for customers, as marketing activities directed towards them should be much more anticipated from their point of view, as well as more targeted at their interests. The authors stress that the GDPR has an important position. Specifically, they mention small and medium-sized business entities, in particular the fact that in their case the time is very important factor for understanding the GDPR. They also note that GDPR will affect all types of marketing activities. As they conclude, ensuring the implementation of marketing activities in the way that is legally consistent with GDPR requires knowledge and assessment of all the requirements imposed by GDPR.

Axinte, Petrică and Bacivarov (2018) deal with the issue of GDPR's impact on corporate governance and, in this context, also with the issue of processing personal data. They specify several factors on which they seek to point and explain why the GDPR is important. An important aspect is that the GDPR has an impact on all business entities, regardless of their size. Another, equally important factor, is that GDPR relates to both online and offline data. Last but not least, they point out that GDPR has an impact on all relationships where there is personal data. It therefore does not matter whether it is a business-to-business, business-to-consumer, employee or supplier relationship. It is also entirely irrelevant whether personal data is processed manually or automatically.

Raschke et al. (2018) mention, inter alia, transparency as one of the main changes resulting from the GDPR. At the same time, however, they draw attention to a persistent question, namely how to ensure the requirement of transparency vis-à-vis the data subject. In this context, they mention the data subject's right of access as a first step towards transparency, which corresponds to the obligation on the part of the personal data controller to ensure the implementation of this right.

Coleti et al. (2020) draw attention to the importance of personal data for business entities, as they can provide important information about both existing and potential customers. Businesses can therefore use them primarily to increase their financial profits. There is a requirement for transparency given by the GDPR. The question is whether and to what extent business entities manage to meet this requirement. Privacy policies are created by businesses to inform their customers about the use of the data, therefore it should be worded clearly and intelligibly.

However, their length and complex wording can be a problem, complicating their understanding by the data subject.

Freitas and da Silva (2018) consider the GDPR to be a challenge for any organization, but especially for small and medium-sized enterprises, due to the smaller human and financial resources available for the implementation of the necessary measures. The authors conducted interviews with ten small and medium-sized enterprises concerning the implementation of GDPR. The main result was the finding of a lack of awareness of their obligations regarding the protection personal data and thus the need to define a methodology how to ensure compliance. The authors also point out that, regardless of the size of the business entities, they must not only be able to ensure but also demonstrate compliance with the GDPR in relation to the personal data of both their employees and customers and suppliers.

Lindgren (2018) considers GDPR to be the cause of a number of challenges for different businesses in different business models. In three case studies, he shows some of these challenges and impacts on businesses and their business models. The author mentions, similarly to some of the above-mentioned authors, that GDPR represents the biggest challenge especially for small and medium-sized enterprises. At the same time, he points out that the existence of different interpretations of GDPR both within the business entity (by managers and employees) and from the external environment (customers, etc.) leads to different levels of GDPR and privacy solutions. The author is of the opinion that GDPR will certainly affect the ability of business entities to implement OBM and OBMI. It is based on the fact that more business entities will be reluctant to open their business, precisely because of the GDPR and related issues of personal data protection.

Like the authors above, Ioan (2018) states that the implementation of GDPR imposes a number of obligations on any personal data controller and processor. And compliance with these obligations is a challenge that includes the necessary changes in both the structure of the business entity and internal policies and processes. It must also be borne in mind that ensuring the protection of personal data is undoubtedly a costly affair.

### **3 METHODOLOGY**

The author chose a qualitative method, namely the focus group, to achieve the purpose pursued by this paper. The chosen qualitative focus group method is intended to gain greater insight into the issue and to gain the views and attitudes of managers of marketing activities, as this is not possible in a purely quantitative research. At the same time, it is necessary to perceive certain limits of qualitative research, namely the problematic generalization of results. However, Silverman (2000) discusses four methods by which the results can be generalized. One of them is a combination of qualitative and quantitative research. As mentioned above, the implementation of the focus group is only the first step in the planned research process focused on GDPR issues in connection with marketing and protection of customers' personal data. Especially with regard to the breadth of this whole topic, the focus group was chosen as the first step in the research process. The aim is to gain the opinions and experiences of experts from practice, which will contribute to the concretization, expansion or, conversely, narrowing of particular problem areas. Specifically, the intention is to find out how SMEs currently perceive GDPR, its implementation, subsequent provision of compliance and how do they assess the impacts of GDPR on marketing and protection of customers' personal data. The results will be used for formulation of some questions of the planned semi-structured interview, which will be the next step of future qualitative research. In addition, the results will also form the basis for the preparation of a quantitative research questionnaire, which will be the last part of the research process. With the help of quantitative research, it will be possible, for example, to find

out how many business entities hold a certain opinion and whether, for example, the difference in the view of certain issues is influenced by the size of the business entity.

Within this paper, the results of the focus group will be presented, that was attended by a total of 6 people, either managers of marketing activities or people who are in charge of this issue in the business entities. As stated by Hendl (2005), the goal of the focus group is to use the limited time to discuss pre-selected topics. On the contrary, the aim is not to reach agreement or disagreement in the group. Morgan (1996) points to a certain advantage of the focus group, which is the possibility of obtaining reactions to the discussed topics from a relatively wide range of participants and at the same time in a relatively short time. Miovský (2006) considers the focus group to be one of the most effective ways of collecting qualitative data.

Lindlof and Taylor (2002) talks about the ideal number of discussants namely 6 – 8 participants. At the same time, he states that in the case of less than 6 persons, some exhaustion of useful and informative observations may occur more quickly. It can be stated that the higher number of participants is directly proportional to the smaller space for each of them to express themselves. Some authors (Agan, Koch & Rumrill, 2008) are of the opinion that in order to ensure the validity of the research, it is necessary to carry out 3 – 5 focus group discussions within the research. However, what the total number of focus groups will be is mainly related to the intention that the focus group should fulfil within the research process. In this context, Miovský (2006) claims that the quality of the obtained data plays an important role and so the number of focus groups is not so important. At the same time, he recommends to follow the saturation rule.

Motivation for people to be part of a focus group may lie in the opportunity to share and compare experiences related to the topic under discussion (Morgan, 2001).

To summarize the fundamental reasons for choosing this qualitative research method, it is first of all an opportunity to find out how managers of marketing activities or people who are in charge of this issue in the business entities think about GDPR in connection with the activities they engage in on a daily basis in practice. Secondly, to find out what opinions they have on selected aspects of this issue, what their views are affected by.

Focus group was carried out with six persons in the second half of May 2020. Micro, small and medium-sized business entities were equally represented within the discussion group. The reason for the involvement of micro, small and medium-sized enterprises is obvious. According to the Report on the Development of the Business Environment in the Czech Republic in 2018 (MPO, 2018), which was prepared by the Ministry of Industry and Trade, several fundamental findings emerge. First, to the date of 31 December 2018, there are a total of 1,154,687 legal and natural persons carried out business activities in the Czech Republic, of which 1,152,735 were small and medium-sized enterprises. It is clear from these data that the share of small and medium-sized enterprises in the total number of active business entities in 2018 was 99.83%. The majority of data for the Report was obtained from Czech Statistical Office, and the methodology of this office works with the division of enterprises into small and medium-sized enterprises exclusively according to the number of employed persons. To the date of 31 December 2018, there were a total of 868 294 natural persons with 0 – 249 employees and 284 441 legal entities with 0 – 249 employees in the Czech Republic.

The persons involved in focus group were marketing activity managers also in charge of GDPR issues, employees in charge of GDPR within the business entity or business owner who dealt with GDPR issues themselves within their company. Business entities were approached for participation in the discussion group at random. The participants in the group discussion were aged between 38 and 53. Two persons were women. All participants had at least a high school education; three had also a university degree. Micro-enterprises, small and medium-sized

business entities were evenly represented within the focus group. Four participants were in an employee position. Two participants were business owners. The sole and decisive criteria for the sorting of business entities into micro-enterprises, small and medium-sized business entities was the number of employees. The motivation for taking part was the theme itself. Most participants said they considered GDPR to be a challenge even after two years of its effectiveness and still a not entirely clear issue. Another reason given for participating was the opportunity to share information and experiences, and at the same time the possibility to find out something new.

### **Focus group theme and research questions**

The topic of focus group was “Perception of GDPR by business entities in the field of marketing activities and protection of personal data of customers”.

Two research questions were set for the focus group, namely:

- 1) How do the managers of marketing activities and persons responsible for the area of GDPR within the business entity perceive the process of GDPR implementation and subsequent ensuring its compliance?
- 2) What is the opinion of business entities on GDPR two years after its effectiveness and how do they assess the impacts of GDPR?

### **Questions and topics for focus group**

With regard to the time limit of the focus group, 10 questions were prepared, which were discussed in the group discussion. Specifically, the following issues were discussed.

- 1) What comes to your mind first when you say GDPR?
- 2) Have your attitude and perception of GDPR changed over the last two and a half years (i.e. between the time of implementation and the present, when GDPR has been effective for two years?)
- 3) Do you think that the smaller the business entity is the more complicated and challenging the implementation of GDPR and subsequently ensuring its compliance is?
- 4) Was your company fully compliant with the GDPR to the effective date? If not, why not? And what is the situation now?
- 5) Do you think that full compliance with the GDPR can give a business entity a competitive advantage over another business entity that for some reason has not ensured full compliance?
- 6) Has GDPR affected the reassessment of data policy within your business entity?
- 7) Can the changes that have been made within your company in connection with the implementation of GDPR be described as “cosmetic” (negligible, very small)?
- 8) Can you tell, from the perspective of the company you represent here, which marketing activities have been most affected by GDPR?
- 9) Do you still perceive any risks in relation to GDPR? If so, which and why?
- 10) How do you retroactively assess the state’s support for small and medium-sized enterprises in implementing the GDPR?

## 4 RESULTS

### Evaluation of questions and topics discussed within the focus group, gained data

Research question number 1 is covered by the focus group's topics marked under numbers 3, 4, 7 and 10. The remaining focus group's topics marked with numbers 1, 2, 5, 6, 8 and 9 relate to the second research question.

The discussion started with **question number 1**: "What comes to your mind first when you say GDPR?" All respondents agreed that GDPR is a concern. Two also mentioned financial expenses; one participant spoke about another administrative burden. Two people identified GDPR as a uselessness associated with uncertainty. The discussion on this issue showed a very similar perception of GDPR by business entities, regardless of whether it is a micro, small or medium-sized business entity.

In the discussion concerning **question number 2**, there were the opinions such as: - "my opinion has not changed, I still think it is just another pile of obligations to all that we have to fulfil", - "in those two years, we have somehow got used to it, or had to get used to it, but I do not see the GDPR positively", - "I do not understand why it is not easier and clearer for a normal person", - "in essence, the GDPR keeps us busy constantly", - "It makes us think about the flow of customers' personal data, but if GDPR did not exist, most of us would welcome it", "GDPR was and is just another burden". The answers of the respondents show their agreement on the attitude and perception of GDPR. It can be stated that their negative attitude has not changed in the course of two years. All of participants see in the GDPR rather only a negative impact on the business and burden. However, one of the respondents also mentioned a certain positivity consisting in a overview of the flow of personal data of customers within the company.

Regarding **the third topic** of the group discussion, even here the participants basically agreed together. Although two of the discussants stated that an external contractor's path had been chosen for implementation, the others confirmed that the company carried out the implementation itself. The reason was that the company did not have the financial means to pay for the services of a lawyer or consulting firm. One of the participants pointed out the fact that a large company has completely different options, mostly with its own legal department and considerable financial resources.

The discussion on **the fourth topic** showed that only two participants were convinced that their company was fully in line with the GDPR on the date of its effectiveness. However, they also admitted that the question is whether the control body would also evaluate it in this way. The other participants admitted that they were definitely not fully in line with the GDPR to the effective date. They also admit that they have mostly done only the necessary matters, but they are still not 100% convinced that they have everything in line. At the same time, they confirm the persistent state of solving problems with GDPR.

**The fifth topic** of discussion concerned the possible competitive advantage of a business entity that ensures full compliance with the GDPR over another that does not achieve compliance for some reason. Three participants agreed that they are not able to assess this and stated that it would be more of a subjective opinion. In addition, one of them stated that there was no significant loss of customers in connection with the recovery of consent for the processing of personal data, which he considers a success. The other three participants are convinced that there is some competitive advantage. They mention, for example, greater transparency and credibility of a business entity that is fully in line with the GDPR, which may influence the customer in his or her decision-making in choosing a business entity for a purchase of goods or services. Another opinion states that there are business entities that have not addressed the GDPR in any way. So, in the case of control and in the case of imposition of a sanction, their

position in the competitive environment will be worse. The third opinion points to a greater perception of customers' personal data. Because businesses are forced to think more about what data they collect and why, they try to use these data to target the customers in a way that doesn't bother them excessively and in order that the customers feel an advantage and benefit for themselves. It can be stated that the participants' opinion on this topic were evenly divided into two groups – one group is of the opinion that the question of possible competitive advantage is very difficult to assess and, moreover, they do not subjectively feel any competitive advantage. While the second group acknowledges the possibility of a certain competitive advantage and gives some examples.

**The sixth topic** of discussion concerned the question of whether GDPR had an impact on the reassessment of data policy within their business entity. All participants state that the data policy has been reconsidered in some way. One participant admits that his company seeks to collect only such personal data that are necessary for performance under the contract or for other legal reasons. In other words, do not have such customers' data where their consent would need to be obtained. The other two participants mention a customer loyalty program, one of them states that his company preferred to cancel this type of program due to the GDPR, the other participant states that his company maintained a customer loyalty program, but it meant additional financial costs. One discussant states that his company has a privacy policy published on its website. At the same time, he adds that even though there was already a national law on personal data protection before the GDPR, no one addressed it much. However, he also raised the interesting question of whether these published privacy policies are actually read by customers. It was also stated during the discussion that rather than "re-evaluating" the data policy, it would be more accurate to talk about "creating" the data policy.

**The seventh question** raised during the discussion was about the oft-cited claim that if business entities were already fulfilling their obligations properly under national law on the protection of personal data before the effectiveness of the GDPR, then the necessary changes in relation to the GDPR would be just negligible. The participants did not agree with this statement. All of them agreed that the changes made were definitely not negligible. These include the need to be able to demonstrate compliance with the GDPR at any time, the ability to respond to the data subject's exercised rights such as deletion or modification, the need to revise contracts, internal rules and directives, the need to adapt software, the need to regularly review compliance with GDPR, and others. All the discussants talk about a lot of administrative work and the complexity of the audit, which was necessary before the actual implementation.

**Question number eight** aimed to identify the marketing activities that were most affected by the GDPR from the perspective of the company represented by the participants. Two discussants talked about customer loyalty programs in this context. Other participants talked about organizing competitions, sending newsletters, e-mails and contacting customers directly.

**The ninth topic** of discussion focused on the perception of risks related to the GDPR. Specifically, whether business entities still perceive any risks in relation to the GDPR and, if so, what and why? All participants confirmed they still perceived certain risks in relation to GDPR, despite the technical and organizational measures that had been taken. There is primarily a concern about controls and possible sanctions. Two participants also mentioned the ambiguity of the legislation and the related possibility of different interpretations of some provisions of the GDPR. Therefore, there is a possibility that even if the business entity acted "with the best knowledge and conscience", there is still a risk that such action may be subsequently assessed by the authority as erroneous and inconsistent with the GDPR. Three discussants agreed that they perceived the risk of possible data leakage, despite security measures. They mentioned the human factor as a potential and the greatest risk. They ask

questions how to prevent data leakage from being caused by the fault of a current or former employee, whether through negligence or wilful misconduct. Concerns have been expressed as to whether it is even possible to ensure that the human factor – the employee – is not the weakest link in the chain.

**The final topic** of the discussion was aimed at finding out how business entities evaluate retrospectively the support of small and medium-sized business entities by the state in the matter of GDPR implementation. All discussants agreed that there was essentially no state support. Two discussants mentioned some information on the GDPR on the website of the Office for Personal Data Protection. However, they state that although the GDPR came into force in 2016 and theoretically there were two years for implementation, articles on GDPR did not start appearing in the press until late 2017 and early 2018. Two participants also mentioned the Handbook for preparing small and medium-sized enterprises for GDPR, published by the Ministry of Industry and Trade. However, they perceive it only as a basic and simplified summary of information, which itself draws attention to its limits and which in real life with the actual implementation did not help them in any way. One participant positively evaluated the website of the Association of Small and Medium-Sized Business Entities, where he found a link to sites focused directly on GDPR, which he considered to be quite beneficial and credible. Three participants literally state that they imagine the support differently. In their opinion, the state should have launched a quality information campaign well in advance, where business entities would get really relevant information and advice. However, there was no such thing and this situation created a huge space for a number of pseudo consultants and experts who offered expensive tailor-made solutions. They add that even today there are a lot of articles on the Internet on how to ensure the implementation of GDPR, but it is always only in general terms what to do first, secondly, thirdly. The discussants agreed that each business entity is different, has different settings, and works with different data. Therefore, any general solution is not a real solution.

Based on the results of the focus group, it is possible to answer the set research questions. However, it should be emphasized that the data obtained in this way cannot be generalized. A summary of the basic and main ideas of discussion on individual topics was made above.

In order to answer research question number 1, it was necessary to obtain the views of the participants in the discussion on questions number 3, 4, 7 and 10. It is not the purpose to repeat again all what was mentioned above as the main output of the discussion on individual topics. Therefore, the answer to individual research questions will be made only by a brief list of the most important ideas.

## Summary of results

An overview of the research questions and the main results for each of them is given in the following table (Tab.1).

Tab. 1 – The overview of research questions and main results for each of them. Source: own research

<b>Focus group theme:</b>	
Perception of GDPR by business entities in the field of marketing activities and protection of personal data of customers	
<p><b>Research question 1:</b> How do the managers of marketing activities and persons responsible for the area of GDPR within the business entity perceive the process of GDPR implementation and subsequent ensuring its compliance?</p> <p><b>Q3</b> - four from six discussants – implementation using own human resources (the reason – limited financial resources for outsourcing)</p>	<p><b>Research question 2:</b> What is the opinion of business entities on GDPR two years after its effectiveness and how do they assess the impacts of GDPR?</p> <p><b>Q1</b> - a concern - financial expenses - administrative burden - uncertainty</p>

**Q4**

- only 2 participants confirmed full compliance to May 2018
- four participants – not fully compliant, only necessary matters were done (the state of addressing the GDPR problems persist)

**Q7**

- opinion consensus of all participants – changes made in connection with GDPR can't be described as negligible
- There is the need to be able to demonstrate compliance with the GDPR at any time, the ability to respond to the data subject's exercised rights, the need to review contracts, internal rules and directives, the need to adapt software, etc.

**Q10**

- all discussants agreed that there was essentially no state support and assistance at the time of implementation or just minimal
- available some information on the website of the Office for Personal Data Protection
- Handbook for preparing small and medium-sized enterprises for GDPR (by Ministry of Industry and Trade) – just basic and simplified summary of main information

**Q2**

- „my opinion has not changed; I still think it is just another pile of obligation to all that we have to fulfil “
- „we have somehow got used to it, but I do not see the GDPR positively “
- „the GDPR keeps us busy constantly “
- „I do not understand why it is not easier and clearer for a normal person“
- „if GDPR did not exist, most of us would welcome it “
- only one participant can see also some positive impact – an overview on the flow of customers' personal data within the company

**Q5**

- three participants are not able to assess it
- three participants agree that there is some competitive advantage (greater transparency of business entity, greater perception of customers' personal data)

**Q6**

- yes – everyone agreed
- for example – data minimization, customer loyalty program
- more than about “re-evaluating” of data policy it is about its “creating”

**Q8**

- customer loyalty program
- organizing competition
- sending newsletters, e-mails
- contacting customers directly

**Q9**

- all participants still perceive some risks in relation to GDPR
- ambiguity of the GDPR legislation
- possibility of different interpretations of some provisions of GDPR
- risk of possible data leakage
- human factor is perceived as a potential and the greatest risk

## 5 DISCUSSION

It can be stated that the results of the focus group clearly proved, among other things, the topicality of the GDPR issue. Although these results cannot be generalized, which is a limitation of the chosen research method, some conclusions can still be drawn from them. However, it should be emphasized that the generalization of the results will be possible to make on the basis of data obtained from planned quantitative research carried out on a sufficiently large sample.

The obtained qualitative data confirm the results and opinions of the authors cited in the literature review. For example, it can be stated that the negative perception of GDPR by business entities, which resulted from research conducted by Martíšková, Humlerová and Štensová (2017), also persists in 2020. The results of the focus group confirmed the opinion and findings presented by Bandyopadhyay and Bandyopadhyay (2018) that many business entities will not be realistically able to achieve full compliance with the GDPR by 25 May 2018. It was also confirmed by all participants in the focus group that the GDPR had an influence on the reassessment of data policy within their organization, which corresponds to the presented opinion of Menon (2019). The focus group participants confirmed that GDPR is a challenge for their micro, small and medium-sized business entities – mainly due to the smaller human and financial resources available both to implement necessary measures and to ensure subsequent compliance. This corresponds to the findings and opinions presented by Freitas and da Silva (2018), Lindgren (2018) and Ioan (2018).

## 6 CONCLUSION

The paper aimed to find out how SMEs currently perceive GDPR, its implementation, subsequent provision of compliance and how do they assess the impact of GDPR on marketing and protection of customers' personal data. Qualitative research, specifically the focus group, was chosen to answer these research questions. The choice of this scientific method was justified. At the same time, however, certain limitations of this method were pointed out, namely the impossibility of generalizing the conclusions reached. Therefore, it was also explained that the purpose of the focus group in this case was to seek the views and opinions of the practitioners who deal with this topic in practise. The findings presented are important for two reasons. On the one hand, it is shown that the GDPR issue is still a highly topical issue, which raises many emotions, questions and ambiguities, and at the same time represents a great challenge for businesses to deal with a number of obligations, principles and rights of the data subject. On the other hand, the knowledge gained from the focus group will be used in future research for the preparation of questions for semi-structured interview, or for the preparation of questionnaire for quantitative research. Within the focus group the opinion was expressed that every business entity is different, has different settings, and works with different personal data. Therefore, any general solution is not a real solution. There is therefore an indisputable space for further research, which will find out how the approach of business entities to marketing and protection of customers' personal data has changed after the effectiveness of GDPR and how in practice not only their behaviour but also their practices, processes and models have had to change. It will also be interesting and beneficial in future research to find out and focus on what business entities in the field of marketing and personal data protection of their customers still perceive as challenge, what is the biggest problem for them and what specific solutions they have adopted.

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# KEYWORD CO-OCCURRENCE ANALYSIS OF A PACKAGING VIBRATION TESTING RELEVANT SAMPLE

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## Abstract

The current paper investigates the keyword co-occurrence analysis method to examine the microstructure of a particular research field of the road induced vibrations from a packaging testing perspective. The sample drawn from a scientific database consists of 121 publications embracing the 1969-2020 years in total. Possible research object describing terms are picked from clusters, which is constituted by the discovery of methodologies applied in vibration-related studies of different subsystems of the pavement-vehicle-package dynamic system. Cluster relevant articles are briefly introduced to understand the findings of the exploratory keyword analysis, supplementary outlooks on relevant methodologies constitute the paper.

**Keywords:** *Keyword co-occurrence, Clustering, Roads and streets, Transportation, Electronic component, Pavements, Protective packaging, Customer satisfaction*

## 1 INTRODUCTION

Graph visualisations are often implemented modelling methods of real-world phenomena or abstract concepts in different fields of interest, such as social sciences, bioinformatics or the semantic web, among others. Bibliometric data analyses and network visualization received close attention since the early days of bibliometric research offering a powerful approach to analyse different bibliometric networks (van Eck & Waltman, 2014). The active strive in publication continuously enriches the state-of-the-art; therefore, more complex systems might be analysed needing advanced visualization techniques. Commonly studied bibliometric relations are co-authorship, co-occurrence, and citation relations. The latter can be further divided into direct citation, co-citation, and bibliographic coupling relations, as in *ibid.*, which also introduce the software VOSviewer at the same time, also used for this study.

The rest of the article is organised as follows: mainstream bibliographic network analysis methods are briefly reviewed; the methodology of deriving the sample and the pre-processing is described; results introduces identified subclusters with relevant findings including micro-reviews; discussion of the presented method follows this; conclusions regarding the co-occurrence analysis and the findings derived from relevant reviews are summarized.

For the convenient traceability, the current paper utilises the present tense format for findings in clusters and the identification of highlighted articles. The past tense formulation is used for the description of the contents of highlighted articles.

## 2 LITERATURE REVIEW

Co-authorship relations are links among researchers, research institutions, or countries based on the number of jointly authored publications. Keyword co-occurrence is based on the number of documents in which both keywords occur together either in title, abstract, or keyword fields. „Two publications are co-cited if there is a third publication that cites both publications” (van Eck & Waltman, 2014), which might be interpreted between publications, researchers, or journals. On the contrary to co-citation „two publications are bibliographically coupled if there is a third publication that is cited by both publications” (van Eck & Waltman, 2014), simply

speaking bibliographic coupling describes the overlap in the reference lists of publications. By direct citations „*articles are linked if one references another*” (Boyack & Klavans, 2010).

Keyword co-occurrence network visualizations, in other words, co-word mapping (Peters & van Raan, 1993) has been implemented related to many different disciplines, such as chemical engineering (Peters & van Raan, 1993), condensed matter physics (Bhattacharya & Basu, 1998), informetric (Sedighi, 2016) or „*quality in higher education*” (Alzafari, 2017) just to name a few examples. Keywords are obtainable from the title, abstract fields, or obviously from the list of keywords provided by the authors of a publication; and -as in current case- index keywords might be appended to the metadata of records by scientific databases.

Different methods are available for visualising bibliographic networks, three of them are highlighted in (van Eck & Waltman, 2014). In a distance-based approach, the distance between two nodes approximately indicates the relatedness of the nodes. In the graph-based approaches, displayed edges indicate the relatedness of nodes. Timeline-based methods make use of publication dates using a dimension to represent time, another for representing relatedness. Bibliometric networks are often weighted graphs, in which links describe the strength of the connection if any *ibid*.

The author proceeds with the hypotheses that subjects, or objects of research are well-manifested through indexing keywords attached to the metadata of publications and the research methodologies can be approximated by corresponding indexing keywords describing theories, methodologies, functions or model names. Since the numerosity of possible goals and motivations of researches is hard even to imagine, these will be discovered through the micro-reviews reclined on abstracts. The review of documents is necessary to understand the context of subjects and corresponding methods.

### 3 METHODOLOGY

A sample consisting of 121 documents is drawn from the Scopus scientific database on March 06<sup>th</sup> 2020 with the term-constellation:

“*packag\* AND vibration AND road AND (simulat\* OR test\*)*”

in the *article title, abstract and keywords* search field. The resulted list of publications is exported in .csv format, including *references* and *abstract and keywords* metadata. The VOSviewer (1.6.14) is used for extracting the author- and index keywords and creating a map based on the bibliographic data from the exported csv.

The co-occurrence of author and index keywords are implemented next. A threshold of 1 and 2 is used for the minimum number of occurrences of keyword resulted in 246 (from 246) and 238 (from 1229) extracted author, and index keywords respectively. The networks with distinct groupings of nodes, i.e. clustered, are available at this point. For further analyses, one might want to save it in of the common formats of network data, such as *gml*, or *net*, where the latter is a format for Pajek. The used Pajek64 (5.08) is a convenient tool to produce adjacency matrix from a network file. The following graphs are produced via Wolfram Mathematica (12.0), and some of the built-in cluster analyses capabilities are used, as well. Since the adjacency matrix defines a network *g*, a graph can be drawn, and the command *FindGraphCommunities [g]* finds clusters within *g*.

The keyword co-occurrence networks are visualised in two ways represented on Fig.1.: the connections of author keywords in a); and the index keywords on b) demonstrate that despite the same sample is analysed, *ceteris paribus* different structures of keywords can be obtained. One underlying reason is that the number of appended index keywords tend to be larger than

those given by authors. In the following network visualisations itself, the sub-clusters from Fig.1.b) are introduced, where the radius of vertices is proportional to the number of connecting edges, representing the weight of the vertices in terms of connections.

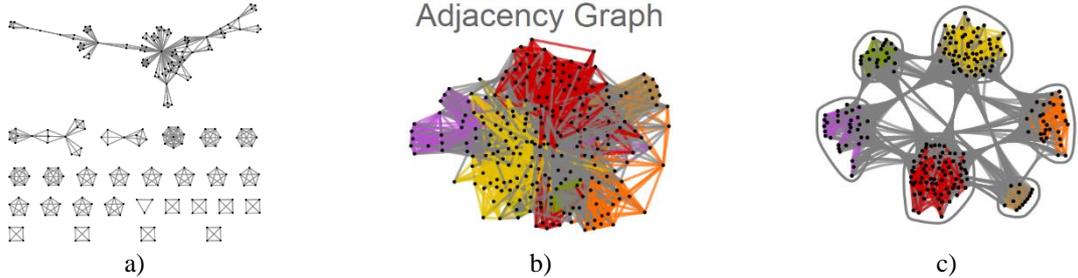


Fig. 1 – Networks of a) author keywords and b) index keywords with clustering and their communities in c).

Source: own research

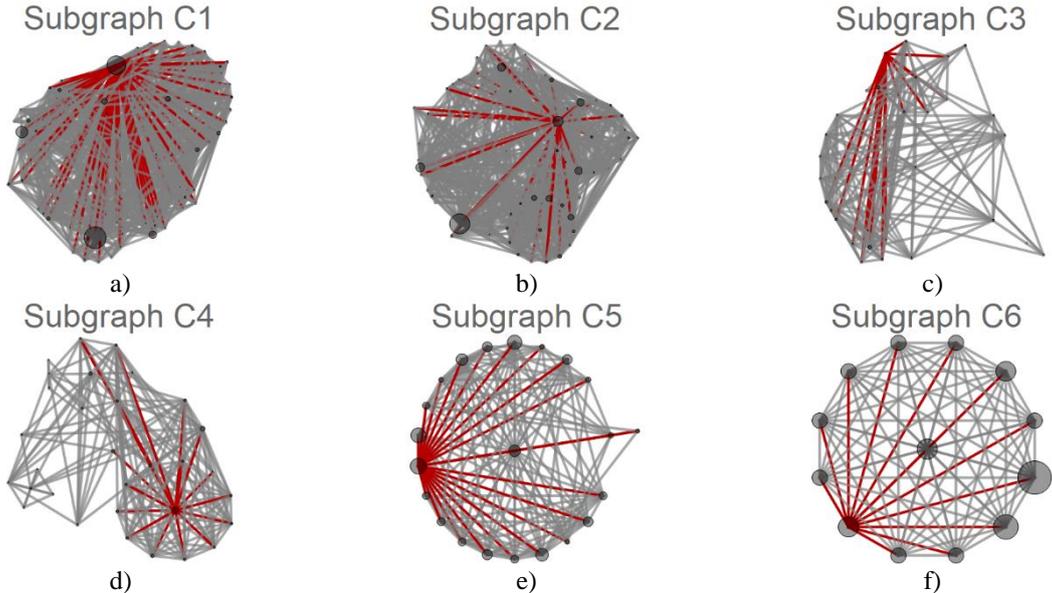


Fig. 2 – Subclusters extracted from the sample, with red lines indicating connections between the representative term and its adjacent vertices. Source: own research

In the followings, a heuristic and admittedly subjective analysis follow. In each sub-cluster, the most weighted vertices are surveyed, and terms describing possible subjects or objects of researches are identified. For instance, *simulation* is assumed to describe a method (despite the existence of publications in general, which research objects are simulations itself) and *roads and streets* are applicable research objects for now. To every subject-describing term per cluster, candidates of research methodology describing terms are looking for among directly connected adjacent vertices, which aims to provide relevant method descriptions on a personal *a priori* practice and assumptions. However, it is not meant to examine all possible connections. Even for a small set of publication (121), the index keywords are capable of multiplying and weaving dense meshes. In many cases, these can be easily obtained from the illustrations. Here shall be noted that the sub-clusters are taken out from the whole network; therefore, connections to other sub-clusters remain hidden. The picked terms are summarised in Tab. 1.

## 4 RESULTS

Six clusters are identified, and possible representatives of the clusters are chosen for now. The used representative terms try to reflect upon vertices having possibly the most connections upon the condition of not describing possible methodologies, but the object or subject of research. Next research methodologies are identified in a semi-subjective manner, which is summarised per cluster in Table 1.

Tab. 1 – Picked index keywords for cluster from Fig.1.b). Source: own research

<b>C.</b>	<b>Subject</b>	<b>Method</b>	<b>References</b>
1	roads and streets	computer simulation	(Sekulić et al., 2016) (Peng & Song, 2002)
		dynamic response	(Zhang & Feng, 2018) (Wu et al., 2013)
		finite element model	(Hsieh, Doan & Chang, 2013)
		mathematical models	(Müller, 2006) (Peng & Song, 2002)
		multibody simulations	(Holdmann & Berger, 2001)
		statistical correlation function; statistical distribution	(Rouillard, Lamb & Losk, 2019) (Rouillard & Lamb, 2020)
		structural analysis	(Lijun, Yang & Zhuoping, 2008)
		transfer functions	(Goktan & Yetkin, 2002) (Peng & Song, 2002)
2	transportation	damage detection	(Zhang & Feng, 2018)
		materials testing	(Böröcz & Singh, 2018)
		measurement and analysis	(Kurniawan et al., 2015) (Soleimani & Ahmadi, 2014) (Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008) (Rissi et al., 2008)
		“spectral densities” let be constituted by the set of: power spectral densities (psd) or power spectral density or spectral density or Power density spectrum (PDS)	(Böröcz & Singh, 2018) (Kurniawan et al., 2015) (Soleimani & Ahmadi, 2014) (Zeng et al., 2017) (Köntges et al., 2016) (Soleimani & Ahmadi, 2015)
		operational modal analysis	(Bernad et al., 2010)
		simulation	(Sekulić et al., 2016) (Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008) (Bernad et al., 2010) (Julien Lepine et al., 2015a) (Ramji et al., 2007) (Turczyn et al., 1984)
		fatigue damage; forecasting	(Saravanan, Sakri & Mohanram, 2008)
		industry standards; reliability	(Meyyappan et al., 2017)
3	electronic component	fatigue damage; forecasting	(Saravanan, Sakri & Mohanram, 2008)
		industry standards; reliability	(Meyyappan et al., 2017)
4	pavements	monitoring; road tests	(Kim, Baek & Yoo, 2010) (Kim et al., 2010)
		“vibration” let be constituted by the set of: ~ measurement or ~ monitoring or ~ sensors	(Kim, Baek & Yoo, 2010) (Kim et al., 2010) (Al-Tarawneh & Huang, 2016) (Chiculita & Frangu, 2015) (Liua, Sun & Feng, 2013) (Rouillard, 2008)
5	protective packaging	artificial intelligence; learning algorithms; learning systems	(Lepine, Rouillard & Sek, 2019) (Lepine, Rouillard & Sek, 2017)
		indexing (of information)	(Lepine, Rouillard & Sek, 2015b)*
		wavelet; discrete ~ transforms; orthogonal ~ transforms; ~ analysis; ~ coefficients; ~ transforms	(Lepine, Rouillard & Sek, 2015b)*
6	customer satisfaction	signal processing	(Lepine, Rouillard & Sek, 2014)
		modal analysis	(Fard, 2011)*

C. denotes the number of clusters; \* denotes duplicate in the sample



of different stack height and road surface under the action of dynamic response characteristics. Numerical simulations of the dynamics of a transported beam had been introduced in (Wu et al., 2013). The model was constituted by a half-car model, the support of the beam on top was modelled by a spring-damping system. The point- and patch contact models were used for the pavement-tyre interactions. The equation of motion of the beam-vehicle system was formulated, and the road surface roughness was assumed to have a *power spectral density* (PSD) defined according to an ISO standard (ISO 8606:1995). The paper aimed to provide references on the vibration problem in transporting a beam-shaped package.

*Finite element modelling* (FEM) is also an applied methodology in the packaging testing discipline, as in (Hsien, Doan & Chang, 2013), which presented the construction of the three-dimensional model of a stroller wheel, and two different road barriers were defined to mimic road conditions, in order to obtain the dynamic analysis.

*Mathematical models* in general can be found almost anywhere, but this is explicitly present as keywords. It is investigated, what kind of models are beyond. A three-dimensional *multi-body* dynamics model of a double-wishbone wheel-suspension system, also containing the steering mechanism had been used in (Müller, 2006) to analyse „*the coactions of these two main parts (...) considering real circumstances like the effect of the movements of the parts of the suspension system to the function of the steering mechanism*” after the investigation of static behaviour of the structure. The motivation of the study originated in need of precise information from the temporary dynamic condition of the vehicle in order to obtain a fast and accurate function of driver assistance systems, e.g. ABS, ASR, ESP. The vehicle ride comfort performance had been simulated in ADAMS in (Peng & Song, 2002), as introduced above.

The ADAMS package has been proposed in (Holdmann & Berger, 2001), as well, but the vertex *multibody simulations* can also be found as direct adjacent to *roads and streets* in C1. The main kinematics and compliance effects of an independent suspension system of a Sports Utility Vehicles (SUV) were explained with different load cases of individual purposes from such as driving on-road and off-road. This highlighted the kinematics and compliance influences of using active systems to control the roll and pitch angles or individual wheel loads.

The authors in (Rouillard, Lamb & Losk, 2019; Rouillard & Lamb, 2020) introduced their investigations on heave, pitch and roll vibration motions, by referring to the susceptibility of containment systems to lateral forces generated by the pitch and roll vibratory motion of vehicles due to road surface unevenness. The paper highlighted the need for multi-axial testing for obtaining more realistic vibration simulations in the packaging testing industry. Beneath time histories and PSD representations of such signals collected, the *statistical distribution* of salient moving RMS statistics had been analysed and investigated the data for *correlation* of the RMS levels with respect to the non-stationarity.

Powertrain and components of a fuel cell passenger car subjected to road simulations have been experimentally investigated in (Lijun, Yang & Zhuoping, 2008). On this purpose, the description of real road load sample on proving ground, road load reproduction on the vibration test rig, total vehicle road simulation test and key components vibration tests were included. „*Structural damage of vehicle body structure and components are observed to evaluate structure strength and operation malfunction of powertrain system. Key components are noted and statistically analyzed to validate the powertrain system reliability under the circumstance of vibration*” *ibid.*

The *transfer functions*, as index keywords are common in (Peng & Song, 2002) and (Goktan & Yetkin, 2002). A vehicle model with 126 degrees of freedom (DoF) was built on the platform of ADAMS in (Peng & Song, 2002), including non-linear factors, such as tire enveloping property on uneven road, the nonlinear damping, bushing, seat rigidity and damping. Given the

road power spectral density (PSD) and the *transfer function* matrix of the N DoF model of the linear vehicle system, the response PSD could be calculated in a frequency domain approach, if the linearity of the vehicle systems holds, stated the authors. However, due to the inexistence of the fixed *frequency characteristic function* for a nonlinear system, the frequency domain approach was considered not applicable. The dynamic behaviour of a vehicle exhaust system was considered in (Goktan & Yetkin, 2002), since exhaust systems were generally decoupled from the vehicle bodies with rubber isolators, causing resonances and contributing to vehicle noise-vibration-harshness (NVH) behaviour and the durability of the exhaust system. The proving ground testing of such systems was referred to as a costly procedure, which had to be repeated for each significantly different combination of the vehicle body, suspension, powertrain and exhaust system components within a vehicle platform. The proposed method was based on the dynamic characteristic of roads and laboratory-measured *transfer functions* of vehicle body and suspension systems.

### **The cluster of transportation**

In the cluster of transportation C2, heavily represented vertices are *vibration analysis* (296), *vibration* (140) and *transportation* (52). Since *vibration analysis* describes rather methodology and the term *vibration* is too general to investigate in such small samples as used here, the vertex transportation is chosen for further analysis in the followings.

The index keyword *damage detection* is connected to *transportation* via (Zhang & Feng, 2018), which studies on random vibration of cargo stacking during *transport*. The article named a few possible factors, such as temperature, humidity, light, static and dynamic pressure, shock and vibration, which could contribute to *damages* in packages. However, only the vibration acceleration of goods was assessed through the simulations. In the study (Böröcz & Singh, 2018), vibration levels occurring in parcel delivery shipments had been measured from pickup to delivery during van transportation, with the goal of the pre-shipment test of new packages to prevent *damage*. In this sense, the measurements were performed for possible materials testing.

A remarkable amount of publications contains the context of *measurement and analysis* (MA), revealing a strong tendency of research methodology related to transportation, like in (Böröcz et al., 2018). Different vehicles had been investigated in terms of analysing the obtained vibration levels in vans (Böröcz & Singh, 2018), on two- and three-wheel delivery vehicles (Kurniawan et al., 2015) and in trucks (Soleimani & Ahmadi, 2014; Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008; Rissi et al., 2008). Possible independent variables can be investigated, such as package location and suspension (Soleimani & Ahmadi, 2014), payload and speed (Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008) or varying road surfaces (asphalt, concrete, stone and dirt) (Rissi et al., 2008). Often not only vertical, but lateral and longitudinal vibrations are recorded, as well. Similar researches often publish PSD of various route conditions (Böröcz & Singh, 2018), or also composite spectra (Böröcz & Singh, 2018; Rissi et al., 2008).

The vertices attributed to PSD has a significant intersection with MA publications (Böröcz & Singh, 2018; Kurniawan et al., 2015; Soleimani & Ahmadi, 2014; Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008; Rissi et al., 2008). The PSD and its acronym formulations often occur in the context, which implies the frequent use of the given function. The reason for that is likely to say, that road excitation signals have a stochastic nature, and many international packaging testing standards (MIL-STD-810G, ISTA4AB) and (Joneson, 2014) make use of the PSD functions in order to describe the energy spread across the frequency range. The publications of (Zeng et al., 2017; Köntges et al., 2016; Soleimani & Ahmadi, 2015) make use of PSD and have also presented measurements. The objects of researches were *fruits* and photovoltaic modules, vibration-sensitive products. Not only these are subjected to road

induced vibrations indeed, but to list of possible products being transported would be impractical in this paper. Other examples from C2 are corrugated containers, and *fruits and vegetables*.

An interesting exception from the MA and PSD based methodologies can be found on the *transportation and operational modal analysis* (OMA) path in (Bernad et al., 2010). The nature of transport vibrations is a frequently discussed topic, in which main trends can be explored, such as PSD profiles describing truck-road characteristics and the non-stationary and non-Gaussian nature of RVVs. However, OMA is introduced as a novel aspect in the given context for the case of corrugated stacked packaging.

The index keyword *simulation* is also adjacent to *transportation*. It has an apparent reason on the above-introduced investigation, namely the packaging testing and simulations carried out in vibration laboratories. However, there are many types of simulations even in computational modelling. Therefore, further investigation is necessary, whether other types of *simulations* can be found, as well. An example of multi-body simulation is presented in (Sekulić et al., 2016), while the developing of simulation of truck transport was in the scope of (Garcia-Romeu-Martinez, Singh & Cloquell-Ballester, 2008). With a different methodology (OMA) but with similar intentions of laboratory simulation of transport vibrations is introduced in (Bernad et al., 2010). The dynamic behaviour of railway coach and bogie frame using *finite element analysis* (FEA) had been carried out in (Ramji et al., 2007), in which Ansys and Hypermesh software were used for the modal, harmonic and transient *simulations*. Thermo-dynamic coupled simulation of railway distribution practices was carried out on frozen food products in (Turczyn et al., 1984), where the word *equipment* anticipated a laboratory test. Another interesting finding is itself the publication (Lepine, Rouillard & Sek, 2015a), which is the review of simulation methods as of 2015 on packaging testing purposes.

Further methodologies can be discovered in the *transportation* represented cluster. A remarkable number of publications deals with the circumstances of measurements and a general and widely used measure to quantify RVV is its description via PSD. However, PSD introduces a time-invariant nature, when transformed back in the time-domain. Therefore, the high amplitude events being present RVVs are eliminated. The harmonic excitations are a rarely discussed circumstance in case of trucks.

*Measurement and analysis* (MA) are cost-intensive, and time-consuming methodologies and virtual. Hence simulations received more emphasis. *Multi-body* dynamic simulation is a remarkable finding in the whole sample, beneath example of finite element methods, both covering computer simulations. Another context of simulations carried out in laboratories has a root in standardized methods of packaging testing, such as (MIL-STD-810G, ISTA4AB) and (Joneson, 2014). It is also discussed in (Lepine, Rouillard & Sek, 2015a), that the standardized packaging testing procedures are often different from real RVVs, investigated through many MA publications.

#### **4.1 The cluster of electronic component**

In subcluster C3 no salient vertices can be found, the term *reliability* (49) seems to have the most connections, but it is associated with methods by the author. The topics are weakly connected in C3 through the represented publications and the reader may find another applicable representative vertex. For now, *electronic component* is chosen as the initial point. This choice is based on *a priori* assumptions about the electronic packages being frequently studied, thus another research topic in vibration testing can be highlighted. The current section introduces a few circumstances in the vibration testing of electronics, based on the analysed abstracts.

Fatigue prediction of electronic packages subjected to random vibrations was discussed in (Saravanan, Sakri & Mohanram, 2008), which presented a general approach for failure analysis and fatigue prediction of electronic components like QFPs under automobile vibration environments. The mechanical failures of surface-mounted electronic components were considered “*major roadblocks in the design cycle and reliability of the product*”. The article named a few of such components (Saravanan, Sakri & Mohanram, 2008) like: *microprocessors, crystals, capacitors, inductors, transformers, ball grid array packages (BGA), quad flat packages (QFP), and chip-scale packages (CSP)*.

In the above-given context *packages* are related to electronics, and (Shannon, 2019) is chosen as representative definition: “*In electronics manufacturing, integrated circuit packaging is the final stage of semiconductor device fabrication, in which the tiny block of semiconducting material is encapsulated in a supporting case that prevents physical damage and corrosion. The case known as “package”, supports the electrical contacts which connect the device to a circuit board. In the integrated circuit industry, the process is often referred to as packaging*”.

Studies were conducted again with *finite element modelling*. Results were used in fatigue life prediction based on Miner's cumulative damage ratio and the three-band technique. It is conspicuous from the examples, that *package* can have a secondary meaning beneath *package*, as *transported good(s)*; and as *circuit packaging* from the integrated circuit industry. This has the consequence of having electronics-related topics in the sample. Furthermore, mechanical damages related to fatigue or vibrations, is a relevant topic in current discipline analysis.

A unique aspect of *electronic package* testing beneath to transported packaging testing originates in the *electronic components* being exposed to vibration risks during their entire lifetime under operational conditions, which is investigated in (Meyyappan et al., 2017). The study is motivated by industry standards being seemingly generic and a knowledge-based qualification framework (KBQ) is used “*to map use conditions to accelerated test requirements*” for solder joint fatigue and socket contact fretting. The qualification requirements via KBQ were compared to standard requirements to verify „*how well industry standard models reflect field reliability risks.*”

#### **4.2 The cluster of *pavements***

The subcluster C4 is represented by the *pavements* (55), which is an expectable term in the context of the pavement-vehicle-package system. Either *monitoring*, as well as *road tests* keywords can be found in both (Kim, Baek & Yoo, 2010; Kim et al., 2010) in which fibre optic pavement monitoring systems were discussed to assess the safety and residual estimate of the life span of highway pavement structures in general. The prototype of the sensor was installed to a curb, and ambient vibration of the vehicles was obtained.

A sensor was designed in (Al-Tarawneh & Huang, 2016), as well in order to facilitate the in-pavement, weigh-in-motion (WIM) measurements at low speed of vehicles passing. The research was motivated by the opinion that the weight of rolling trucks being one of the critical factors for the management of road networks due to the continuous increase in truck weights.

A low-cost car vibration acquisition system was presented in (Chiculita & Frangu, 2015) on different motivations, such as the assessment of pavement-, vehicle status or passenger's comfort. The work concentrates mainly on the introduction of the measurement system design.

Similar to cluster C3 *electronic component*, the scope of research in (Liua, Sun & Feng, 2013) was to reveal the reliability and influencing factors of MEMS on board level using FEM and random vibration response simulation method, for which the loading was defined as PSD of different pavement levels.

The paper (Rouillard, 2008) shows a good correlation again with the term *pavement*, which presented a method to generate vibration simulation schedules for road transport vehicles, utilising *pavement* profile data, regarding package performance testing in a laboratory.

#### **4.3 The cluster of *protective packaging***

In the case of cluster C5, one could quickly identify *vehicle vibrations* (58) or *acoustic noise* (60) as the scope of research. Easily associable choices could also be the *transient vibrations* (48), and *non-stationary random vibration* (48). Without further indication, the current section describes the context of *protective packaging* (64) following the primary intention of this paper.

A novel approach had been implemented, making use of machine learning algorithms, such as *Decision Tree*, *k-Nearest Neighbours (kNN)*, *Bagged Ensemble* and *Support Vector Machine (SVM)* in (Lepine, Rouillard & Sek, 2019) and SVM in (Lepine, Rouillard & Sek, 2017). The articles investigated the performance of the algorithms in order to assess its capabilities on the identification and characterisation of shocks in RVVs. Synthetic signals had been analysed in (Lepine, Rouillard & Sek, 2017), while the SVM classifier via real RVV was tested in (Julien Lepine, Rouillard & Sek, 2019). Different predictors had been used for the classifiers, like *moving RMS*, *moving Crest factor*, *moving kurtosis*, *Hilbert-Huang-Transform (HHT)*, *Discrete Wavelet Transform (DWT)*, mirroring a primary intention: the methods *in se* have severe limitations, especially when the underlying random vibrations are non-stationary (Julien Lepine, Rouillard & Sek, 2019). This is justified by a subsequent study found in the cluster, as well. The capabilities of the *wavelet* transform to *index* RVV mixed-mode signals had been presented in (Lepine, Rouillard & Sek, 2015b). The study concluded that DWT using Daubechies 10 wavelet had good sensitivity for harmonic and transient events, but a poor performance for non-stationary segment detection. The HHT had been subsequently studied in (Lepine, Rouillard & Sek, 2014) with similar motivations concluding, that Hilbert-spectrum can only be used to detect the presence of different components with certain limitations in order to identify the harmonic and transient components to be separated from the underlying random Gaussian sequence.

#### **4.4 The cluster of *customer satisfaction***

A complete graph is obtained in C6, the *modal analysis* (62) is interpreted as a methodology and *driving conditions* (37) seems another applicable subject of research. However, since a corresponding publication (Fard, 2011) reflects first in its abstract on *customer satisfaction* (38) from NVH point of view, it is chosen as a representative term.

In (Fard, 2011) the acoustic signatures and corresponding seat rattle noise sources were investigated on various seat components with modal testing and analysis, noise measurement, and impact hammering test. Sine sweep excitation was used for the experiments as input vibration, and the seat's vibration and noise responses were measured and analysed using various equipment and software packages. In scope of the study was to obtain the seat rattle noise acoustic signature, which could be used to distinguish noise sources and optimize the structural NVH.

The effects of front suspension parameters on road wheel toe dynamics were studied in (Wang & Rui, 2001) also referring to *customer satisfaction* in the first tense of the abstract, such as “*front road wheel toe dynamics directly affects tire wear and steering wheel vibration, which in turn negatively impacts customer satisfaction.*”

## **5 DISCUSSION**

One might look for relevant publications in scientific databases to discover a field of science, perhaps ranks the records sorted descending by number of citations. Beginning with the most

cited references, going step-by-step until a satisfactory limit, cognitively “*a sort of*” clustering might be formed, as well.

If explicitly the rank of keywords is in interest, an empirical probability distribution function might be obtained, but the connection of terms remains hidden. The network visualization reveals not only the weight of terms, but their connections. Still one question remains: what is the scientific cohesion between terms? The presented method has an admittedly subjective process in order to answer this question related to the sample. The approach consists two steps: 1) finding the most weighted term in a sub-cluster, describing possible subject or object of research at the same time; and 2) finding methodology describing terms among connections of the vertex found in the first step. The reader may find other possible methods, which would better fit the personal assumptions, or even could find terms different from the chosen ones. This heuristic feature is the main compromise in current analyses, the method is subjective and based on a priori knowledge. Furthermore, it cannot be guaranteed -only hypothesised for now- that connections between terms are meaningful, but there is a reason for the connections since those are given among metadata. The visualisation of weighted edges might offer an orientation in this case. despite graphs are visualising connections

Despite disadvantages presented here, the above investigation had a semi-structural method and a time-effective way of work to screen the literature, in the author's opinion. The used sample consisted of 121 records with 119 individual publications and 2 duplications. The author finds this sample size satisfactory on demonstration purposes, but one might need different sample sizes. As it was presented on the synonyms of PSD, closely related terms are present in the sample. One might decide to cluster similar terms, but care should be taken since this affect the original data. Possible investigations could cover the differences of clustering between weighted and unweighted graphs if any.

To summarize, the graph-visualisation can be an attractive method; the review of the content of publications necessarily required. Although the author has some good experiences with the current approach, it cannot be deducted as a generally applicable solution.

## 6 CONCLUSION

The bibliographic network visualisations have well-established methods, different software solutions are available to examine e.g. co-authorship-, citation- or keyword co-occurrence relationships. The current paper introduces an approach for exploring a bibliographic dataset drawn from the Scopus scientific database, consisting 121 records. The visualisations have the advantage of representing complex networks in weighted graphs, the main advantage derives from the discovery of the system of connections between terms, offering another kind of structured way of exploring a set of publications. The remaining task to understand the context of findings via reviewing the content of records is inevitable.

*In se* six clusters are defined, for each a representative term is chosen. Different aspects of the *pavement-vehicle-package* systems can be investigated. The serviceability and different statistics used to describe road profiles are research topics in order to *monitoring* state of roads or to predict the life span of highways, which faces the problem of *pavements* being loaded. Since road unevenness contributes to road induced vibration in vehicles, a few publications have made the evidence in a separate cluster, that publications are devoted to analysing NVH circumstances of vehicles. Remarkable vertex is *vehicles* after *roads and streets* in the same cluster, indicating that vehicles are highly discussed research objects. Generally, one could be interested in understanding the dynamic behaviour of vehicles, travelling on uneven road surfaces, or the riding qualities, or ride comfort. Most common techniques use *multi-body*

*simulation* methods in the software package ADAMS. Beneath, examples of FEM and *numerical simulation* of analytical models also can be found.

A secondary meaning of *packaging*, as *circuit packaging* is present in the context, straying the reader not far from the topic described in title. Different *electronic components* are subjected to vibrations not only during *transportation* of the product but in their entire lifetime under operational conditions. The fatigue prediction of similar structures is a current research area, in some cases investigated via FEM.

On the side of *packages* as transported goods, high number of publications describe *measurement and analysis* (MA) circumstances of RVVs. A general and widely used measure to quantify RVV is its description via PSD. Since MA is a cost-intensive and time-consuming processes, virtual *simulations* also received emphasis, for which again *multi-body dynamic simulation* is an example. If one cannot measure the excitation signals, operational modal analysis (OMA) might serve as an appealing methodological framework. The other context of simulations carried out in laboratories has a root in standardized methods of packaging testing. Standardized packaging testing procedures are often different from real RVVs (Lepine, Rouillard & Sek, 2015a), investigated in many MA publications. Transported goods are therefore equipped with *protective packaging* to avoid loss or damage. Examples of *state-of-the-art* techniques are presented, such as *machine learning algorithms*, which can utilise different predictors, e.g. advanced time-frequency domain analyses, like *wavelet transform* or the novel *Hilbert-Huang-transform* in the direct goal to understand RVVs better and to produce better simulation methods.

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# PLS-SEM OR CB-SEM? THE UTILIZATION OF PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELLING METHOD IN THE RECENT RESEARCH ARTICLES ON THE ENTREPRENEURIAL ORIENTATION OF SMALL AND MEDIUM-SIZED ENTERPRISES

*Vojtěch Hrubý*

## **Abstract**

This article analyses the utilization of the variance based structural equation modelling method partial least squares (PLS-SEM) in the context of recent research of the Entrepreneurial Orientation (EO) construct and the method's supposed advantages over its more popular sibling – the covariance based structural equation method (CB-SEM). The number of empirical applications of structural equation modelling and partial least squares in particular in social science research has risen dramatically during last two years. Some authors criticize the PLS approach to SEM, others argue in its favour. The Entrepreneurial Orientation as the key concept of Entrepreneurship from the perspective of scientific research has great potential for taking advantage of PLS-SEM. This study sifts through the examples of application of PLS-SEM in leading strategic management journals and assesses them from the perspective of arguments for selecting PLS-SEM over CB-SEM and from the perspective of appropriateness of PLS-SEM method for the research of the Entrepreneurial Orientation construct. The article concludes that PLS-SEM and CB-SEM can both be successfully used and the decision on which one to use must be based on an analysis of actual research context. The findings aspire to help better understand advantages, limitations and problematic aspects of the application of PLS-SEM in the EO research.

**Keywords:** *CB-SEM, Entrepreneurial Orientation, Latent Variable Analysis, PLS-SEM, SEM critique*

## **1 INTRODUCTION**

Entrepreneurship is often considered the essential power behind the productivity and growth of firms. Empirical findings suggest, that entrepreneurial activities can strengthen firms' productivity, especially the productivity of small and medium firms (Covin, Green & Slevin, 2006). There are various definitions of entrepreneurship in the literature. In the eighteenth-century Richard Cantillon defined entrepreneurship as a process of self-employment with uncertain results. He saw its essence in the willingness to take on risks. Schumpeter (2013), an important economist of the first half of the twentieth century, wrote about the entrepreneurship and its impact on the economic development. He envisioned entrepreneurs as individuals, whose main function was to develop new combinations, i.e. to introduce new products. In other words, Schumpeter combined entrepreneurship with innovation. Based on various definitions of entrepreneurship it can be concluded, that the essence of it is the ability to identify market opportunities together with the willingness to pursue them by implementing innovations with the aim to maximize profit.

Entrepreneurial orientation is the key concept of entrepreneurship from the perspective of scientific research. It can be perceived as a firm level entrepreneurial activity (Covin & Wales, 2012) and as far as some authors are concerned a key ingredient of an organization's success. Miller (2011) was the first to develop the theory of entrepreneurial orientation in 1983. In his view EO comprises of firms' innovativeness, risk taking and pro-activeness. Lumpkin and Dess

(1996) took the theory further, adding two more dimensions critical for describing entrepreneurial firms: a) autonomy and b) competitive aggressiveness. Entrepreneurial orientation of an organization then relates to its tendency to operate autonomously, carry out innovations, engage in risky activities and react pro-actively and aggressively in the competitive environment with the aim to gain a competitive advantage (Lumpkin & Dess, 1996). There is an ongoing debate in the research community about the extent to which individual dimensions of entrepreneurial orientation must be present in a firm, so it can be considered as entrepreneurially oriented. Miller (2011) assumed that only firms, that have all dimensions should be considered as firms with entrepreneurial orientation. On the other hand, Lumpkin and Dess (1996) opposed this view claiming, that a firm engaging in any combination of EO dimensions can be considered as entrepreneurially oriented. It can be concluded that in order to become entrepreneurially oriented a firm does not need to exhibit all five dimensions at the same time. Considering that the entrepreneurial orientation concept is multidimensional, the influence of individual dimensions can be observed independently (Lumpkin & Dess, 1996).

PLS method (Partial Least Squares) has become popular in recent years in the research of Entrepreneurial orientation. It is one of the methods of regression analysis, which consists of statistical methods used to estimate values or mean values of a variable corresponding to given values of one or a number of explaining variables (Hindls, Hronová & Novák, 2000). PLS method can be used for solving regression problems, i.e. modelling correlations between two blocks of variables. Social science researchers often utilize statistical methods for verifying research result. PLS method is an example of so-called SEM (Structural Equation Modelling) methods, allowing researchers to model variables, that cannot be measured directly and at the same time to calculate measurement errors for variables, which can be measured.

## **2 THEORETICAL BACKGROUND**

Entrepreneurial Orientation (EO) has become over the last two decades an important concept featuring in research papers on the topic of strategic management and entrepreneurship. It has often been examined through PLS-SEM discussed later in this article. EO is a frequently examined dimension of strategy making with a profound influence on a firm's performance (Miller, 2011). Rauch et al. (2009), who assessed past studies on the relation between EO and performance discovered a significant worldwide growth of studies published on this subject. They concluded the EO represents a perspective field for building relevant knowledge on entrepreneurship.

EO concept as today commonly defined in the scientific literature was first formulated in 1983 by Miller (2011), who described the entrepreneurial organization as engaging in product innovation, exhibiting somewhat risky behaviour and being proactive towards the competition. Lumpkin and Dess (1996) who followed up on Miller's work, widened the EO definition by adding two more dimensions: competitive aggressiveness and autonomy and emphasized that all dimension can change independently in a given situation. Lumpkin and Dess (1996) argued, that an organization in order to succeed needs its leaders to be able to act autonomously, without limitation enforced by the firm's bureaucracy. Competitive aggressiveness reflects how an organization responds to risks.

### **Autonomy**

Autonomy is an expression of an independent spirit that is important for anything new. In the organizational context it expresses actions taken independently from any organizational limitations. At the individual or team level it can be perceived as taking independent actions or as an ability or willingness to direct oneself in the course of realization (Lumpkin & Dess,

1996). There are two levels of autonomy: structural and strategic. Structural autonomy enables teams to solve problems by its own means. Strategic autonomy calls on a level, where teams can control its own goals. In the context of the EO concept, autonomy is considered to be strategic (Lumpkin, Cogliser & Schneider, 2009).

### **Innovativeness**

Schumpeter (2013) was the first to connect innovativeness and entrepreneurship. He described the economic process of creative destruction, when the wealth is being created by introducing new products and services in the market, which leads to the shift of resources from the existing companies and to creation of new companies. He described the factor behind this introduction of new products and services as entrepreneurship, which he further described a competitive entry of new combinations. Innovativeness is willingness to support creativity and experimenting with the goal of introducing new products or services, technological leadership and the research and development of new processes (Lumpkin & Dess, 2001).

### **Risk Taking**

There is a link between risk taking and a tendency to carry out courageous actions, such as entering a new market, assigning considerable resources to projects with uncertain outcomes, or taking on significant debt (Lumpkin & Dess, 2001). Organizations that create radical innovations must be willing to accept financial and commercial risks in order to succeed. On the other hand, a fast decision making often related to risk taking contradicts a detailed analysis and negotiation, which are necessary for the identification of weaknesses and existing technology and products' potential (Kollmann & Stockmann, 2010).

### **Pro-activeness**

In order to successfully take advantage of market opportunities it is important to act first. That usually results in larger profits and the one who took the action first gains advantage in brand building. Therefore, the initiative in utilizing new opportunities and markets is connected with entrepreneurship. Pro-activeness in this context is an opportunity seeking, forward looking perspective comprising the introduction of new products and services ahead of competitors (Lumpkin & Dess, 1996).

### **Competitive Aggressiveness**

Lumpkin and Dess (1996) posited that competitive aggressiveness expressed a firm's propensity to directly and intensely attack competitors with the goal of entering a new market or improving its own position, i.e. beating competition under market conditions. A firm expresses its competitive aggressiveness in the way it interacts. The interaction may take a form of direct competition or a direct attack of competitors, e.g. in a situation when a firm enters a market where the competitor is already present. The interaction may also take form of a direct answer to the competitor's action, e.g. a firm can lower prices and sacrifice its profit in order to keep its market share in the situation when a competitor launches a new product (Lumpkin & Dess, 1996). Competitive aggressiveness can improve firm's performance, because the focus on overcoming competition increases firms' competitiveness at the expense of rivals (Lumpkin & Dess, 1996).

### **3 METHODOLOGY**

#### **Structural Equation Modelling**

Structural equation modelling - SEM – combines: a) latent variables representing a theoretical concept (e.g. Entrepreneurial Orientation), b) measured data (indicators, manifested variables) that is used as an input for the statistical analysis resulting in the proof of relations among latent variables (Williams, Vandenberg & Edwards, 2009). SEM is a combination of two traditions: a) econometric approach focused on prediction (e.g. models of linear regression), b) psychometric approach (factor analysis) modelling concepts based on latent variables derived indirectly from more measured values (indicators or manifested variables) (Chin, 1998). SEM evaluates two types of model: a) measurement model (outer model), which expresses the dependence between latent variables and their indicators, b) structural model (inner model), which expresses relations among latent variables. These relations reflect hypothesis based on theoretical assumptions (Mora, 2012).

SEM provides a researcher with the option to: a) model relations among predictors (independent variables) and criterions (dependent variables), b) take into consideration latent variables, measured by indicators (measure variables), c) model measurement errors for measured variables and d) statistically test theoretical assumptions against empirical data. The holistic analysis, which SEM is capable of, is feasible with two statistical techniques: a) covariance-based SEM, b) variance-based SEM – PLS (Roldán & Sánchez-Franco, 2012).

#### **PLS – SEM (Partial Least Squares Structural Equation Modelling) Method**

PLS method was developed by Herman Wold with the aim of reflecting on theoretical and empirical conditions common in behavioural social sciences. Wold himself labelled PLS as a soft modelling. The mathematical model is soft in a sense that it does not make any assumptions about measurement, distribution and sample size (Wold, 1991). The basic PLS algorithm runs in two phases: a) during the first phase the score of a latent variable is iteratively estimated, b) in the second phase final estimations are calculated (Hair, Ringle & Sarstedt, 2011). Paths modelling with PLS can be used for explanatory as well as predictive research, where a) explanatory model is a model built to test causal hypotheses, which specify how and why a particular empirical phenomenon exists, b) predictive models focus on predicting new or future observations or scenarios.

#### **CB – SEM (Covariance Based Structural Equation Modelling) Method**

Since its creation in 1973 by Karl Jöreskog this method has kindled lively interest among researchers across all fields of the social science research. The method's popularity was helped by increased availability of software tools, e.g. LISREL, EQS and AMOS. CB-SEM represents a different approach to the solving of the same problem as the PLS-SEM method, i.e. the analysis of the relation between the cause and effect among latent constructs. These methods differ not only in their basic assumptions, but also in the process of the estimate's creation. PLS-SEM uses a regression-based estimation method ordinary least squares to explain variance of a latent construct by minimizing error conditions and by maximizing R<sup>2</sup> values of the target endogenous construct. On the other hand, CB-SEM estimates maximum probability with the goal of reproducing the covariance matrix (i.e. minimizing the difference between the observed and estimated covariance matrix) without focusing on the explained variance. In other words, with CB-SEM method R<sup>2</sup> is a by-product of the main statistical goal of achieving a good fit of the model (Hair, Ringle & Sarstedt, 2011).

## 4 RESULTS

When considering which of the approaches to SEM to choose, it is advisable to understand well the characteristics and goals that differentiate these two methods (Hair, 2017). The less developed and advanced the researched theory is, especially in situations when the primary goal of SEM is a prediction and explanation of target constructs, the more suitable PLS-SEM is (Rigdon, 2012).

One of the main differences between PLS-SEM and CB-SEM is in a way they treat latent variables, which are part of the model. CB-SEM considers constructs as common factors, which explain covariance of their indicators, when the scores of those common indicators are neither known nor necessary for the estimation of the model's parameters. On the other hand, to represent constructs PLS-SEM uses proxies, which are weighted composites of varying indicators of the given construct. Therefore PLS-SEM is described as a composite oriented approach to SEM, which frees the strict assumption of CB-SEM, that all covariance among indicators is explained by a common factor (Hair, 2017).

It is important to realize that proxies used by PLS-SEM, are not identical with constructs, but rather their approximation. For this reason, some scholars consider CB-SEM a more direct and exact method for the empirical measurement of theoretical concepts, whereas PLS-SEM produces only approximations. There are opinions that common factors obtained with CB-SEM are also not necessarily equal to theoretical concepts, which are the object of research.

Hair, Ringle and Sarstedt (2011) defined the following rules for selecting an appropriate approach to SEM. PLS-SEM is more suitable when: i) the goal is prediction of target constructs, or identification of the main constructs of the theoretical model, ii) formatively measured constructs are part of the model (formatively measured construct can, under certain circumstances, be part of CB-SEM models too), iii) structural model is complex with a large number of constructs and indicators, iv) the sample size is small or the data is not normally distributed, v) there is a plan to utilize the score of latent variables in following analyses. On the other hand, the use of CB-SEM is more suitable on occasions when: i) the goal of research is testing or confirming a theory, or comparing alternative theories, ii) error conditions require additional specification, e.g. covariance, iii) structural model contains circular dependencies, iv) research requires the global criteria of the good fit.

Both methods differ and are designed to obtain different results and are based on different approaches to measurement. It is obvious that PLS-SEM cannot be recommended as a universal alternative to CB-SEM in the research of the Entrepreneurial Orientation. None of the two methods is superior and cannot be universally used in all situations (Hair, 2017). In other words, it is important for researchers to pick a method that is best appropriate to the goal of their research, data characteristics and the way the model is set (Roldán & Sánchez-Franco, 2012).

## 5 DISCUSSION

One of the leading strategic management scientific journals – Long Range Planning – repeatedly dedicated an entire edition to PLS-SEM (Sarstedt et al., 2014; Hair, Ringle & Sarstedt, 2012), with some of the articles touching on the subject of entrepreneurship. It is obvious that with PLS-SEM's growing popularity there are not fewer of its opponents (Ronkko & Evermann, 2013), who criticize its inconsistency in the parameter's estimation, inability to model measurement errors and validate the measurement model. Ronkko and Evermann (2013) claim that the majority of assumptions connected with PLS-SEM is not based on the statistical theory and simulation studies, but rather on earlier published articles, which do not provide sufficient proves for their claims. Henseler et al. (2014) on the other hand, doubt the above-

mentioned critique of the method and unlike Ronkko and Evermann (2013) answer positively to the following 4 questions: (1) Is PLS a method of SEM? (2) Can PLS be used for the measurement model validation? (3) Does PLS have a requirement for a minimal sample size? (4) Is PLS suitable for early research phases? The authors conclude that there is not a single method suitable for every model, every distribution, every set of parameters and every sample size. There can always be situations when a given method will not work as intended, i.e. it is always possible to come up with a setup, when a given method will not work (Henseler et al., 2014).

## 6 CONCLUSION

The utilization of SEM is generally considered to be appropriate for social science research especially because the majority of key concepts is not directly observable. SEM allows modelling relations among many independent and dependent variables including latent variables measured by indicators. The holistic analysis of SEM can be carried out by two different statistical methods (Barroso, Carrión & Roldán, 2010): 1) covariance-based CB-SEM, 2) variance-based PLS-SEM, when both were designed to achieve different results. CB-SEM focuses on estimating such model parameters, that the theoretical covariant matrix resulting from the system of structural equations is as close as possible to the empirical covariant matrix observed in a sample (Reinartz, Haenlein & Henseler, 2009). PLS-SEM works with blocks of variables and estimates model parameters by maximizing the explained variance of all dependent variables (Chin, 1998).

According to Löhmeller (2013) the basic PLS algorithm runs in two phases. In the first phase the score of a latent theoretical variable is iteratively estimated in a four steps process. Second phase calculates final estimates of coefficients using ordinary least squares OLS method for every particular regression in the model.

Hair (2017) reports, that the number of scientific articles using PLS in renowned scientific journals has risen exponentially and that there are dozens of such articles published every year. Numerous examples of PLS-SEM use in the business research can be found in the field of the strategic management (Hair et al., 2012), and also in the research of entrepreneurial orientation, marketing (Hair, Ringle & Sarstedt, 2011), supply chain management (Kaufmann & Gaeckler, 2015), information systems (Roldán & Sánchez-Franco, 2012) and family entrepreneurship (Casillas, Moreno & Barbero, 2011).

It can be therefore assumed that PLS-SEM is a suitable and appropriate method for the author's upcoming research of the relations between entrepreneurial orientation and performance of small and medium enterprises in the chemical industry in the Czech Republic.

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# SOCIAL NETWORK MARKETING COMMUNICATION OF RAILWAY PASSENGER TRANSPORT COMPANIES

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## **Abstract**

The issue of marketing communication of any institution or company is nowadays a very current topic not only from a scientific point of view but also from a practical point of view. Companies need to communicate effectively with their target groups because they can increase their competitiveness. Due to the fact that social media (for example Facebook, Instagram, LinkedIn, Twitter etc.) are very popular with many users of the younger and middle generation, they can become an effective tool for marketing communication. The purpose of the paper is to explore the use of social network marketing communication of railway passenger transport companies. The aim of the paper is to analyse social media marketing communication (using the social network Facebook) of the selected railway passenger transport companies in 2019. The following scientific methods are used in the paper: the content analysis of the Facebook profiles of the selected railway passenger transport companies in 2019, comparative analysis using descriptive statistics and synthesis of the results. The results of the analysis showed that RegioJet chooses an intensive, Czech Railways a conservative and Leo Express a defensive communication strategy. Each of the analysed companies set their activities differently in terms of the frequency of posts and their content. The limit of the paper is the fact that only the three most important companies and only the social network Facebook were analysed. The added value of the paper consists of comparing the strategies of social network marketing communication of selected companies.

**Keywords:** *social network, marketing communication, railway passenger transport, Czech Railways, Leo Express, RegioJet*

## **1 INTRODUCTION**

The rail passenger transport market in the Czech Republic has been liberalized, thanks to which several companies are competing for the operation of rail transport. Companies must communicate effectively not only with transport customers (Ministry of Transport of the Czech Republic, regions and municipalities), but also with passengers, to whom they also offer connections within commercial lines.

Historically, the railway transport in the Czech Republic was operated only by the Czech national carrier, former incumbent České dráhy, a.s. (Czech Railways Company). Since 2011 the railway passenger transport market has been opened to other competitors – RegioJet a.s. entered the market. Soon afterwards, in 2012, another competitor joined the market – Leo Express s.r.o. In the following years, other carriers subsequently entered this market.

With increasing competition in the market, carriers had to improve the quality of services provided and also focus on the issue of marketing communication. Marketing communication is important for many stakeholders (for example passengers, customers – Ministry of Transport of the Czech Republic, regions and municipalities, shareholders, creditors and suppliers) from the perspective of railway carriers. Due to the long-term trend of increasing popularity of social media (for example Facebook, Instagram, LinkedIn, Twitter, etc.) among the younger and middle generation, railway passenger carriers also had to start using them. This paper focuses only on the use of the social network Facebook by selected railway carriers, because this social

network has the most users worldwide. Marketing communication using the social network Facebook is low-cost, targeted and very effective. The social network Facebook is an excellent platform for dynamic communication with the young and middle generation.

In general, it can be stated that railway passenger transport companies use social network marketing communication because they have established profiles on the most used social networks (Facebook and Instagram). On the other hand, there is no scientific paper that has examined and analysed this type of communication from the perspective of the used strategy, the content of communication and the frequency of communication. The gap is thus identified in these three areas mentioned above.

## **2 THEORETICAL BACKGROUND**

Functioning marketing communication is undoubtedly one of the most important prerequisites for a successful business, which of course also applies in the field of transport services. At present, new media, especially social networks, are increasingly used to communicate with customers. The professional literature also deals with marketing communication via social media in some detail.

### **Social media in marketing communication**

Hristache, Paicu and Ismail (2014) state that the image and behaviour of a modern organization is inextricably linked to communication, and that the image of a successful company is now formed under the strong influence of social media. Correia, Medina, Romo and Contreras-Espinosa (2014) recommend organizations to reflect on the ways in which they communicate with their target audience and consider social networks and mobile technologies as a new way to expand business. They argue that it is important to monitor behaviour on Facebook and other social networks to understand the users of these networks. Subsequently, in their opinion, marketing and communication steps should be formulated to help turn fans into customers. Varey (2008) reflects on the industrial society of the past and the so-called interaction society of the future, the characteristic feature of which is the emergence of various social networks in work groups and in private life. He understands marketing as the social interaction of the market from which values arise. He believes that limiting marketing to mere communication and consecutive sale means not exploiting the possibility of public participation in the creation of these values, and that there is a need to move from a monologue to a dialogue. This is evidenced by Klepek and Starzyczna (2018), who claim that communication is no longer one-way, but two-way, which has its advantages and disadvantages. However, in a highly competitive environment, as they state, it is necessary not only to talk, but also to listen. They believe that the role of two-way communication will be crucial in the future. Bacile, Ye and Swilley (2014), on the other hand, compare marketing communication through mass media and personal media. In the mass media, organizations send messages and then evaluate the results through passive feedback. In contrast, in the personal media, it is possible to involve the customer by providing an opportunity to participate in co-creating the communication process. They add that this creates active feedback, where customers are no longer passive audiences but become active participants in this process.

### **Traditional versus new media**

Winer (2009) also deals with new communication approaches in marketing and mentions new media, the characteristic feature of which is that they are digital and interactive, which brings both opportunities and problems. According to him, social networks such as Facebook etc. attract the most attention from these new media. He adds that the growing popularity of these

networks has caused that user-generated content and discussions can lead to influential communities that facilitate communication between people with similar interests. However, he also points out that communication through traditional media was one-way and could be fully controlled. The new media, on the other hand, do not allow such control. According to him, blogs and social networks are completely out of the control of marketing managers, who cannot influence online conversations in any way, and thus also what messages about the brand are spread through them. Onishi and Manchanda (2012) respond to the sharp rise of new media and address themselves to the question of whether these new media strengthen or, conversely, damage the effectiveness of the traditional media and vice versa. According to them, this is especially important because the traditional media drain financial resources, while the new media are available for free. Their research shows that the new and the traditional media work synergically, but it also depends on whether it is the period before the launch of a new product or a service, or the period when the product or the service is already on the market. Pauwels, Demirci, Yildirim and Srinivasan (2016) specify that managers of lesser-known brands can gain significant synergies through offline marketing spending, while managers of well-known brands can create more synergies through various online media. However, they add that although research into synergistic effects is on the rise, the conditions for creating synergies are still largely neglected.

### **Social media and advertising**

Breuer and Brettel (2012) examine the short-term and the long-term effects of online advertising and recommend the inclusion of social media advertising in the evaluation of these effects on different customer groups. They argue that people are spending more and more time using social media, and therefore the importance of these media for advertising purposes is growing. Grewal et al. (2016) report that social media, such as Facebook, Twitter and YouTube, today attract hundreds of millions of users. At the same time, they are convinced that these media, thanks to their analytical potential, subsequently provide a great overview of advertisers, who thus have new opportunities to target their communication. They also highlight the fact that users often connect to these media via their mobile devices, which they use not only to make phone calls and send text messages, but also to browse websites, work with various applications, etc., which facilitates the delivery of advertising messages. On the other hand, Shen et al. (2016) point out that the more advertising there is, the more likely it is that customers will get tired of it and start ignoring it. They therefore recommend increasing its interactivity, e.g. through games or tests, which makes it more interesting for customers.

Liu et al. (2015) argue that finding effective influencers in online environment of social media is crucial for electronic word-of-mouth marketing, because it can help reduce costs and create more business opportunities. They deal with how to find suitable influencers, then it is possible to use various marketing procedures to involve them. According to them, users of social networks prefer interactions with members of their interest group and are influenced by their opinions. This is also confirmed by Abri and Valaee (2020), who consider the ability to find influencers to be crucial for an effective viral marketing strategy. Majlesirad and Shoushtari (2020) demonstrate the significant role of celebrities and important personalities in the environment of social networks on the example of luxury brands.

### **Social media and brands**

Lund, Cohen and Scarles (2018) regard social media as a space for telling stories that spread through that space and influence values and perceptions. As they believe, this also causes a change in the perception of brands, which should be understood as a result of the interpretation of narrated stories in social groups. Social media provides many opportunities, e.g. travel stories

presented through these media have become a popular tool to awaken the reader's empathy, and empathy can be considered a decisive factor in emotions (Akgün et al., 2015). Swani and Milne (2017) confirm that the use of emotions evokes deeper involvement, motivates users to comment and share content, so emotional appeals in posts supporting the brand are useful. Mora and Vila (2018) recommend creating viral videos and spreading them on social networks to strengthen the brand. Porto, Mendonça and Milan (2016) prove that strengthening the brand on social networks is also possible through parallel communication activities, especially in the field of publicity, sales promotion and advertising, which can bring synergy effects.

### **Measurement of activities within social media**

Jeong et al. (2017) consider social media, such as Facebook, Twitter, etc., to be the most influential media for networking and building social relationships. They remind that the influence of individual subjects within social networks is determined by the number of relevant indicators that they obtain. In the case of Facebook, for example, it is the number of "likes" obtained. However, they point out that this fact can be easily misused in an effort to increase the importance or the reputation of certain subjects, by generating false indicators. Swani and Milne (2017) believes that the size of the fan base and the length of time the post is active have a great influence on "likes" and comments. Their research has shown that service messages generate more comments than those focused on goods. Customers who have no previous experience with the service learn from others. At the same time, they argue that using a brand is more effective at generating more "likes" and comments in service messages than in goods messages. Conversely, images and videos in messages generate more "likes" and comments on goods than on services.

Royle and Laing (2014) conducted research that showed the need for more efficient measurement and evaluation processes for digital marketing practices, although there are a number of built-in measurement systems, such as the number of "likes" on Facebook, that enable to measure digital marketing activities in some way. Pelletier and Horky (2015) found that for "liked" brands, the intention to buy is much more common for products than for services, but a simple quantification of "likes" on Facebook should not be interpreted as a measure of customer involvement. They distinguish between passive interaction ("liking" or reading posts) and active interaction (commenting and sharing) and add that passive interaction can also bring benefits, for example, the brand becomes more aware. In addition, the loudest and most active followers are not the only ones affected by the report. They add that new followers of corporate Facebook are not necessarily new customers of the company, but may be existing customers, which again points to the synergy between Facebook and other types of promotion.

### **Use of social media in marketing communication of railway companies**

There are relatively few authors who address marketing communication through social media within railway companies in their publications. Narayanaswami (2018), which examines the situation in the Indian Railways environment, or Yang and Anwar (2016), which focuses on the evaluation of railway services in New South Wales, Australia, deal with the issue of digital social media and their use in the practice of railway companies. Furthermore, Gabore and Xiujun (2018) discuss the impact of online news on the views of social media users and give an example of the construction of the first modern international line in Africa, namely Ethiopia-Djibouti. It is obvious that this issue is not sufficiently described in professional literature and requires a broader examination, especially with regard to the situation in the Czech Republic.

### 3 METHODOLOGY

The processing methodology consisted of four steps (see Fig. 1). The railway passenger transport companies suitable for the analysis were identified in the first step. They were companies that achieved the highest transport performance in 2019 and have a profile on the social network Facebook; there were: České dráhy, a.s. (further in the text Czech Railways or abbreviated “CR”), RegioJet a.s. (further in the text RegioJet or abbreviated “RJ”) and Leo Express s.r.o. (further in the text Leo Express or abbreviated “LE”).

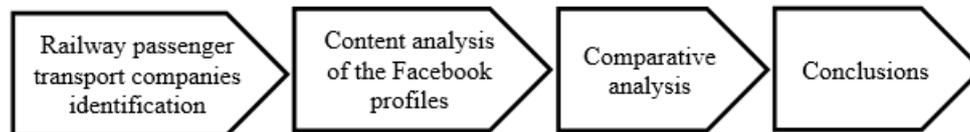


Fig. 1 – The processing methodology. Source: own research

The method of content analysis was used to analyse Facebook profiles (České dráhy, 2020; Leo Express, 2020; RegioJet CZ, 2020) of the analysed companies as a second step. The method of content analysis is a research technique for making replicable and valid inferences from texts or other meaningful matter to the context of their use (Krippendorff, 2003). The method of content analysis has been used, for example, in Soule et al. (2019). The Facebook profiles of the analysed companies were analysed by two independent researchers in March 2020 for the entire period of 2019 (from 1 January 2019 to 31 December 2019), subsequently, a synthesis of the results was performed. The content analysis of the Facebook profiles of the analysed companies was focused on: the total number of posts; the number of followers; the frequency of posts (by days); the total number of likes; the maximum number of likes; the total number of likes by type (like, love, haha, wow, sad and angry); the total number of comments and shares; the average number of likes, comments and shares and likes by type (like, love, haha, wow, sad and angry); the types of posts (post with video, post with web link); the content of the posts.

The method of comparative analysis was used to compare the social network marketing communication by analysed railway passenger transport companies with the use of the social network Facebook in 2019 as a third step. The method of comparative analysis is a data analysis technique for determining which logical conclusions a data set supports; comparative analysis begins with listing all the combinations of variables observed in the data set, followed by applying the rules of logical inference to determine which descriptive inferences or implications the data supports (Ragin, 1987). At the same time, descriptive statistic (arithmetic mean) was used. Finally, a synthesis of the knowledge obtained using content analysis and comparative analysis was performed, and conclusions were defined as a fourth step. The aim of the paper is to analyse the social network marketing communication (using the social network Facebook) of the selected railway passenger transport companies in 2019.

### 4 RESULTS

Czech Railways, RegioJet and Leo Express have profiles on the social network Facebook. The results section is divided into four areas: results of the analysis of basic indicators (subchapter 4.1), results of the frequency analysis of posts (subchapter 4.2), results of the interaction analysis (subchapter 4.3) and results of the content analysis of posts (subchapter 4.4).

#### Results of the analysis of basic indicators

The most people like and follow the Facebook profile of RegioJet (86 232 people like this profile and 85 558 people follow this profile). The company Leo Express has about 81 thousand

followers and the carrier Czech Railways has about 75 thousand followers. This information and all other information provided were valid as of March 31, 2020. In total, all three analysed companies presented 610 posts on Facebook in 2019 (Tab. 1). The most posts were published by RegioJet (256 posts), followed by 204 posts of Czech Railways and 150 posts presented by Leo Express. Thus, a total of 610 posts were analysed using content analysis and comparative analysis.

Tab. 1 – The overview of the basic data (valid as of March 31, 2020). Source: own research

<b>Facebook social network (for 2019)</b>	<b>CR</b>	<b>RJ</b>	<b>LE</b>
Number of people who like this	73 461	86 232	81 040
Number of people who follow this	75 289	85 558	81 266
Total number of posts	204	256	150
Total number of likes	51 997	35 659	11 696
Total number of comments	11 993	16 263	4 615
Total number of shares	10 056	1 714	1 285

Next, the total number of likes was analysed. The posts of Czech Railways received the most likes (a total of 51 997 likes), followed by RegioJet (a total of 35 659 likes) and by Leo Express (a total of 11 696 likes). Posts of the company RegioJet were the most commented (a total of 16 263 comments), followed by the company Czech Railways (a total of 11 993 comments) and the company Leo Express (a total of 4 615 comments). On the other hand, the posts of Czech Railways were the most shared (a total of 10 056 shares). The posts of RegioJet and Leo Express achieved a lower number of shares. Based on these values, it can be stated that the interaction of the posts of individual carriers is very different. Some carriers have reached a high number of likes and shares (Czech Railways), but they had only 204 posts in 2019. On the other hand, RegioJet presented 256 posts, but achieved a lower number of likes and shares. However, the posts of RegioJet were the most commented in 2019. In 2019, Leo Express presented the fewest posts on Facebook (only 150 posts). This is also one of the reasons why Leo Express has received the least likes, comments and shares.

### **Results of the frequency analysis of posts**

Furthermore, the frequency of posts was analysed. The average time between posts in 2019 for the analysed companies was as follows: 1.43 day for the company RegioJet, 1.76 day for the company Czech Railways and 2.43 days for the company Leo Express. The longest time between two published posts in 2019 was: 8 days for the company Czech Railways (between 30. 4. 2019 and 8. 5. 2019), 7 days for the company Leo Express (between 14. 1. 2019 and 21. 1. 2019) and 5 days for the company RegioJet (between 13. 12. 2019 and 18. 12. 2019). Companies should try to spread the publication of posts evenly so that there are no large time gaps between posts. A time gap of 5 days or more can lead to loss of contact with followers.

Furthermore, the number of times when 2 or more posts were published in one day was analysed. Publishing multiple posts in one day can be problematic and reduce the reach of individual posts and their interaction. The carrier RegioJet published a total of 32 times 2 or more posts in one day. On February 18, 2019 this carrier published 3 posts in one day and on February 19, 2019 even 4 posts in one day. Czech Railways also published posts similarly, because a total of 23 times presented 2 or more posts in one day. Czech Railways published on November 16, 2019 and on December 2, 2019 a total of 3 posts in one day.

Leo Express published only 2 times 2 or more posts in one day. The frequency analysis of the posts by days on the social network Facebook in 2019 (Fig. 2) showed that companies Czech Railways and RegioJet used weekends (Saturdays and Sundays) to a very limited extent for publication of posts. RegioJet published only 8.20% of the total number of posts on weekends in 2019 and Czech Railways published 11.76% of the total number of posts in the same period.

On the other hand, the carrier Leo Express published a total of 29.33% of posts on the weekends in 2019, but published only 6.67% of posts on Fridays unlike both competitors. The fact that Czech Railways published the most posts on Tuesdays, Wednesdays and Thursdays (a total of 65.20% of all posts) is also very remarkable.

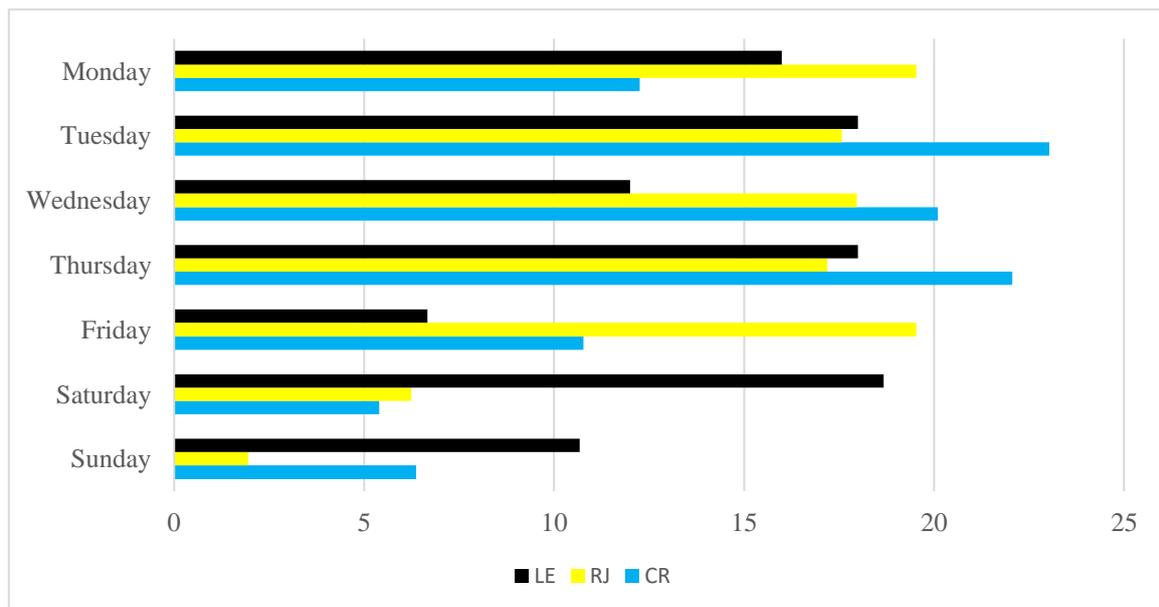


Fig. 2 – The frequency of the posts by days on Facebook in 2019 (%). Source: own research

### Results of the interaction analysis

In 2019, the posts of all three analysed carriers received a total of 99 352 likes (Tab. 2). The posts of Czech Railways received the most likes in 2019 (a total of 51 997 likes) followed by company RegioJet (a total of 35 659 likes) and Leo Express (a total of 11 696 likes).

Tab. 2 – The total number and the average number of likes by type, comments and shares. Source: own research

Facebook social network (for 2019)	Like	Love	Haha	Wow	Sad	Angry	Comments	Shares
LE (total amount)	10 418	813	141	267	10	47	4 615	1 285
RJ (total amount)	29 640	3 616	1 407	825	92	79	16 263	1 714
CR (total amount)	41 162	5 033	3 420	1 363	989	63	11 993	10 056
LE (average number per 1 post)	69.45	5.42	0.94	1.78	0.07	0.31	30.77	8.57
RJ (average number per 1 post)	115.78	14.13	5.50	3.22	0.36	0.31	63.53	6.70
CR (average number per 1 post)	201.77	24.67	16.76	6.68	4.85	0.31	58.79	49.29

It is also very remarkable that every roughly eighth like in the posts of Czech Railways and RegioJet was of the "love" type, while in the case of Leo Express it was roughly every thirteenth like.

The posts of Czech Railways also showed a significant number of "haha" and "sad" likes in 2019. RegioJet achieved the largest number of comments on posts (a total of 16 263 comments), however, on the other hand, the posts of Czech Railways were the most shared (a total of 10 056 shares). The analysis showed that Czech Railways achieves better results with fewer posts than RegioJet. Czech Railways has the same or better average result per post according to the types of likes than the other analysed carriers (201.77 likes per post, 24.67 "love" per post, 16.76 "haha" per post, 6.68 "wow" per post, 4.89 "sad" per post and 0.31 "angry" per post). RegioJet, on the other hand, can activate users very well to comment on posts, as it received an average of 63.56 comments per post (Czech Railways gained 58.79 comments per post and Leo Express 30.77 comments per post). Czech Railways clearly leads in the average number of post

sharing, because each post is shared on average 49.29 times in contrast with 7 to 9 times at Leo Express and RegioJet.

Posts of the analysed carriers with the largest number of likes in 2019 are presented in the Fig. 3. The post of the company Leo Express received 2 631 likes, 342 comments and 576 shares, it was published on September 18, 2019. The post is focused on the presentation of a new train unit named “Leo Express Sirius”. The post of the company RegioJet received 1 238 likes, 494 comments and 17 shares, it was published on April 29, 2019.



Fig. 3 – The posts with the largest number of likes on Facebook in 2019. Source: České dráhy (2020), Leo Express (2020), RegioJet CZ (2020)

The post is focused on the survey of whether users prefer travelling by train or by bus. The post of the company Czech Railways received 5 205 likes, 135 comments and 816 shares, it was published on July 2, 2019. The post is focused on the presentation of the Police Symphony Orchestra as a part of its busking tour which ended at the festival Rock for People. A total of 610 posts were analysed, and video was used in 112 posts (76 video-posts of Czech Railways, 24 video-posts of Leo Express and 12 video-posts of RegioJet). The video-posts of Czech Railways were liked many times, commented and shared, but the shooting of video-posts is associated with higher marketing communication costs. The companies use links to the websites that are a part of posts. A total of 610 posts were analysed and the web link was used in 359 posts (it was 58.85%). The links to the websites are an excellent addition to the posts and will direct those interested outside the social network to the carrier's website. The links to the websites in the posts were mostly used by Czech Railways (139 times) in 2019, followed by RegioJet (127 times) and Leo Express (93 times).

### Results of the content analysis of posts

Furthermore, the content of the posts was analysed. All 610 analysed posts were divided into these thematic areas by two independent researchers: survey, magazine promotion, destination promotion, event promotion, photos taken by fans and employees, recruitment marketing, partnership, operational information, discount promotion, promotion of services, competitions, introduction of employees and other (Fig. 4). Each of the companies uses a different marketing communication strategy. In 2019, Czech Railways focused its posts on the following areas: promotion of services (34.31% of posts), event promotion (24.51% of posts) and destination promotion (14.22% of posts). RegioJet focused its posts on these thematic areas: photos taken by fans and employees (17.97% of posts), destination promotion (16.80% of posts), promotion of services (12.89% of posts) and introduction of employees (10.94% of posts). The carrier Leo Express presented posts focused on: destination promotion (18.00% of posts), promotion of

services (16.67% of posts), event promotion (14.67% of posts), discount promotion (12.00% of posts) and operational information (10.67% of posts).

The most significant fluctuations were recorded in the following content areas: promotion of services (Czech Railways – 34.31% of posts compared with 12.89% of posts for RegioJet and 16.67% for Leo Express), introduction of employees (RegioJet – 10.94% of posts compared with 4.00% of posts for Leo Express and 0.49% for Czech Railways), photos taken by fans and employees (RegioJet – 17.97% of posts compared with 4.00% of posts for Leo Express and 1.96% for Czech Railways) and event promotion (Czech Railways – 24.51% of posts compared with 7.42% of posts for RegioJet and 14.67% for Leo Express).

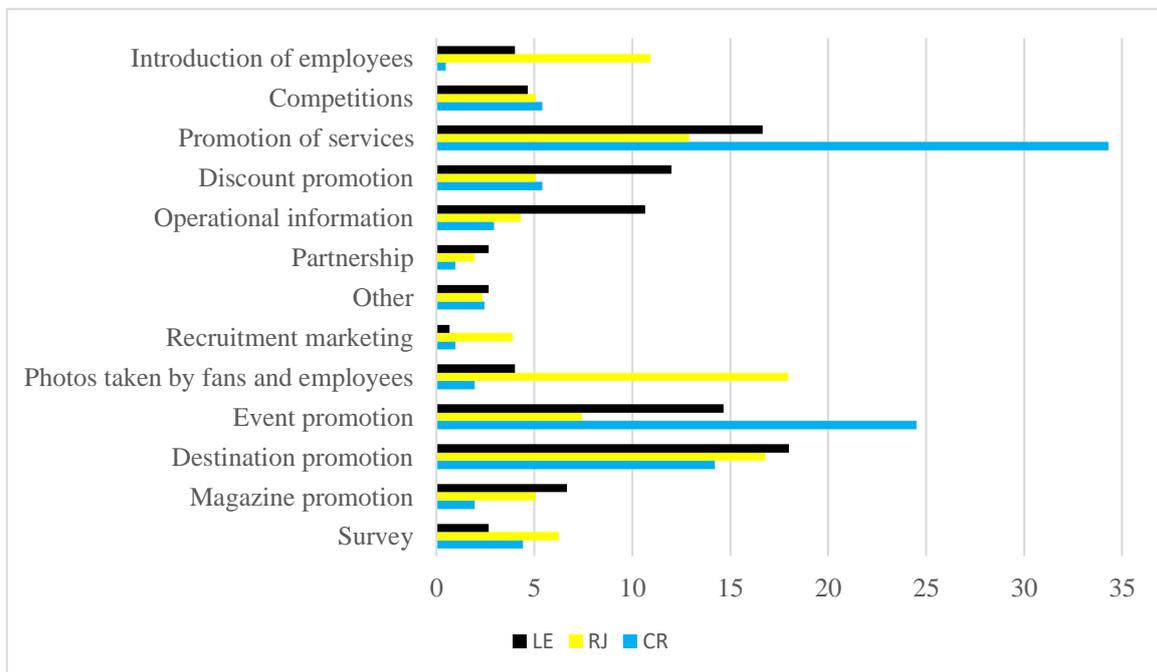


Fig. 4 – The content of the posts on Facebook in 2019 (%). Source: own research

The remaining thematic areas of marketing communication of the analysed railway passenger transport carriers in 2019 were relatively balanced and similar (survey, magazine promotion, destination promotion, recruitment marketing, operational information, discount promotion, competitions, introduction of employees and other).

## 5 DISCUSSION

In total, all three analysed companies (Czech Railways, RegioJet and Leo Express) presented 610 posts on Facebook in 2019. All 610 posts and 99 352 likes were analysed by two independent researchers with the use of two scientific methods, specifically content analysis and comparative analysis.

The results of the analysis showed that RegioJet chooses the path of an intensive communication strategy on the social network Facebook, where it publishes a large number of posts (a total of 256 published posts in 2019). Czech Railways has chosen a conservative strategy (a total of 204 posts) and Leo Express a defensive strategy (a total of 150 posts). Another important fact is that RegioJet tries to add new posts to its profile regularly (the longest time between two posts was 5 days). The carriers Czech Railways and Leo Express reported the time between posts of more than 7 days, which is a very long period of time on social networks. A serious problem of RegioJet and Czech Railways is the publication of several posts in one day. The carrier RegioJet published a total of 32 times and Czech Railways a total of 23

times 2 or more posts in one day. On some days, the carriers even published 3 or more posts in one day. This can lead to a reduction in the reach of individual posts, and it is necessary to better plan marketing communication campaigns.

The conservative communication strategy of Czech Railways led to better average results converted into one post in terms of: average number of likes, average number of likes according to individual types and shares. Followers of Czech Railways are very active in terms of sharing posts (49.29 shares per post) and liking posts (255.05 likes per post). On the other hand, the followers of the carrier RegioJet are very active in terms of commenting on posts (63.53 comments per post).

The great advantage of Czech Railways is the use of video-posts (a total of 76 video-posts in 2019). These video-posts were very liked, commented and shared. All three analysed carriers use links to websites from their posts that redirect visitors very well. Based on the results of the frequency analysis, it can be stated that companies Czech Railways and RegioJet used weekends to a very limited extent for publication of posts. On the other hand, the carrier Leo Express published a total of 29.33% of posts on weekends in 2019, but published only 6.67% of posts on Friday unlike both competitors. The analysed carriers should distribute the posts more evenly throughout the week, of course in relation to the activity of the target groups.

The analysed companies should also focus more on the content of the posts because, for example, RegioJet makes great use of dynamic cooperation with its followers and promotes their photos on its profile. Czech Railways use a large number of partnerships and co-organized events for self-promotion. A very positive activity is also the introduction of employees as realized mainly by RegioJet on its profile.

Furthermore, it is necessary to emphasize the fact that it is very difficult to discuss the results of this scientific paper in the context of other studies, because there is no other such focused study in the field of railway passenger transport companies or a similar field in internationally respected scientific databases Web of Science and Scopus.

## **6 CONCLUSION**

Social media is currently a common part of marketing communication. When it comes to social networking, a Facebook profile is taken for granted, if not a necessity. It can be said that even the most important railway carriers in the Czech Republic understand this fact and that they actively use the new possibilities of communication with customers, specifically through Facebook. These are companies providing services that are intangible, which means certain specifics in communication. However, each of the surveyed companies has its own communication strategy, which is also reflected in its Facebook activities. The analysis showed that individual companies have different approaches in terms of frequency and content of communication, in certain aspects the reactions of their audience also differ. However, the differences are not significant, each of the companies has better results in some respect, but in other it lags somewhat behind the others. From the overall point of view, it can be stated that the mentioned companies try to attract attention and fight for customers through various means of the social network Facebook. Of course, there is room for further improvement of communication, and companies should focus on deeper analyses and interpretation of the results of their activities as well as behaviour of social networks users. As follows from this paper, it is also possible to draw lessons and inspiration from the activities of competitors.

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# AN EMPIRICAL ANALYSIS OF “BRAND POPULARITY” ON SECOND-HAND PRODUCTS: A PERSPECTIVE FROM INTERNATIONAL STUDENTS IN THE CZECH REPUBLIC

*Miloslava Chovancova, Abdul Bashiru Jibril, Michael Adu Kwarteng, Daniel Edem Adzovie, John Amoah*

## Abstract

The swift growth of second-hand market is one of the key indicators for the 21st Century Markets. The consumption or usage of used-goods (i.e. second-hand products) is on the rise among e-commerce and traditional goods markets. The purpose of this study is to ascertain the impact of brand popularity on customer buying decision regarding second-hand products. In other words, this paper sought to answer questions on ‘why’ and ‘how’ customers consider buying a second-hand product despite relatively low prices of these products particularly among university students’ purchase intent and other low-income earners. Using a pilot study, forty-one international students of Tomas Bata University in the Czech Republic took part in the study. With a descriptive analysis and a simple linear regression, there was a significant relationship between brand popularity and the buying of second-hand product among consumers. The practical implication of this research offers a conceptual model to marketers and dealers in the second-hand product retail market on how best they could re-consider their branding strategy to win customers.

**Keywords:** *well-known brands, second-hand products, data comprehension, brand recognition level, buying decision, markets, Czech Republic*

## 1 INTRODUCTION

Branding is one of the main focuses of today’s marketing activities and also one of the most important tool/assets for positioning which a company/organisation can use for its growth and survival (Hunt, 2019; Jibril et al., 2019a). The latest focus of branding research has been about the buying behaviour of consumers and their attitudes about the power of the brand which is mostly related to economic and ecological aspects. The concept “brand popularity” is a term used to describe the extent to which a brand is widely purchased by the general public (Clifton, 2009; Sahay & Sharma, 2010). In other words, it has often been operationally defined as the market share of a product (Hellofs & Jacobson, 1999).

In the 21st century market, research about brands with regards to customers’ buying behaviour shows us that people could tend to buy second-hand products per the brand attribute they have in mind (Barnes & Higgins, 2020; Bronnenberg, Dubé, & Moorthy, 2019; Sahay & Sharma, 2010). On the other hand, Second-Hand Market is consistently growing in recent years, which is undeniable. An example is the Global Data of Analytics, which predicts that the used-product market will grow to reach at 51 trillion dollars in 2023 (Alonso-Gonzalez, Peris-Ortiz, & Cao-Alvira, 2019). In view of this, the second-hand market offers the opportunity for customers to experience the use of expensive products. Thus, it increases the recognition of brands. Available studies observed show that the sales of a brand that has taken part in the second-hand market increased when new products were released. Therefore, companies with well-known brands (brand popularity) want to maintain their strength in the second-hand market for a larger market share. They further emphasize that their marketing strategies can be successful in second-hand

markets if firms and marketers concentrate much of marketing research on brand as an essential driver of customer's purchase intention (Thomas, 2003).

However, understanding the brands pattern in the behaviour of consumers, particularly among international students, is one of the most important antecedents to the success of business organizations. Again, students in general are noted in the literature to be in the brackets of low-income earners, and for that matter their purchasing behaviour toward second-hand market is quite high. Meanwhile, literature on brand is constantly analysing the patterns of brands in buying behaviour to predict the future positions of companies. Against this background, the present study seeks to analyse the influence of the "brand popularity" on second-hand products among international students in the Czech Republic. In other words, we examine how the influence of brand authority and brand positioning trigger the buying behaviour of customers for used products.

To conclude, in theory, the study further deepens the extant literature on consumer behaviour towards brand concept in the marketing field, whereas in practice, the study informs the practitioners (traders, dealers, agents etc.) of second-hand goods regarding their market segmentation and the target market. The remainder of the article is as follows: we reviewed literature on well-known brands in the second section; the third section contains the study methodology; the result and discussion formed the fourth section; and the fifth section concludes the study with future research direction.

## **2 LITERATURE REVIEW**

Generally, brand plays a crucial role in the buying decision of customers in the goods market, such as electronics, fashion, groceries, among others (De Chernatony, 1989; Dzisi & Ofosu, 2014). As a matter of fact, well-known brand (i.e. brand popularity) is noted by marketing practitioners and scholars as the asset of the firm and the driving force of the customer toward product acquisition in the market. In the second-hand goods market, the upsurge in used-product (second-hand goods) consumption has drawn attention to scholars and practitioners whilst this development has raised a question like; why do consumers continue to search for or buy used-products? (Guiot & Roux, 2010; Roux & Guiot, 2008). Interestingly, an answer from Argo, Dahl and Morales (2006) indicates that product/brand popularity largely trigger the buying decision of used-product among patrons of retail market.

Moreover, pioneer researchers (Kotler et al., 2003; Kotler & Gertner, 2002; Wood, 2000), in their works, debated convincingly that brand element on products and services denote a key asset to the producer or the company in question. They further argue that a brand describes an identity, a symbol, a name or a trade mark which denotes a product or service quality among others, and could be distinct from competition or competitors.

In view of this, the extant literature, particularly from the marketing perspective, revealed that branding is widely perceived as a key strategic asset in marketing through which existing and upcoming business entities in general garner more customers from the market environment. Interestingly, it has become highly important for SME's in today's business, since branding with respect to products and firms, create an enabling environment that speeds up customer-centric performance outcome (Jibril et al., 2019b; Osakwe, 2016; Osakwe et al., 2015). Pappu, Quester, and Cooksey (2005) in their study, posited that customer-centric performance outcome like brand as a product characteristic largely relates to consumer-based brand equity which subsequently translates into market place equity.

However, customers in general are seen as the essential key players for decision-making process regarding product design and development. Therefore, it suggests that, shoppers, in their quest

to purchase a used-product to their satisfaction, prefer to consider the quality and the popularity of the brand. By extension, brand orientation as a customer-driver, and for that matter a marketing strategy, is very imperative in achieving a competitive advantage among practitioners of second-hand markets.

Having this in mind, the authors therefore summarise the above literature in a conceptual framework (see figure 1) and propose that:

*H1: Brand popularity positively triggers customers purchase decision on buying a second-hand product.*

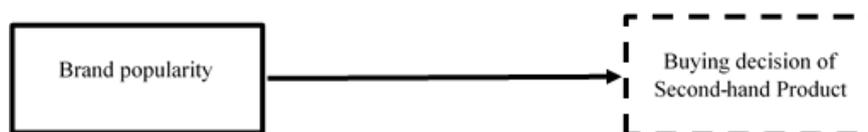


Fig. 1 – A conceptual framework. Source: own research

### 3 METHODOLOGY

To achieve the study objective, the current study presents a pilot study using a close-ended questionnaire with 41 respondents comprising international students (mostly Erasmus) from the Faculty of Management and Economics, Tomas Bata University in Zlín in the Czech Republic. The purpose of this pilot study is to help the authors to identify any unclear research questions/statements so that we could re-adjust the study procedure to undertake a full-study in the future.

In measuring the relevance of our proposed hypothesis in this article, we performed descriptive analysis using a single independent variable with several dimensions/statements as well as single dependent variable.

Again, we developed 6-point Likert Scale questionnaire ranging from 1-very weak to 6-very strong (see Table 3). In this pilot study, similar questions were asked differently in order to ascertain the perception and feeling they (customers) exhibit towards selecting a product in the second-hand market to buy while the main reason for this was to ensure the reliability of the answers obtained from the participants by using control questions.

### 4 RESULTS AND DISCUSSION

Our research result was revealed through a simple linear regression. To this end, there are 4 different possible cases explaining the relationship between dependent and independent variables. You could see this relationship in more detail from Table A in the appendix.

To reiterate our hypothesis – *H1: Brand popularity positively triggers customers purchase decision on buying a second-hand product.* In other words, this hypothesis was proposed to suggest that brand recognition would positively influence customers in their quest to buy a second-hand product.

Using Minitab 16 and SPSS 23.0 as the statistical software for data analysis, results from Anderson-Darling Normality Test indicate that the mean score of measuring recognition of brands (brand popularity) is 5.1220 with a range of 6. This revelation from the pilot study suggests that, participants (students) recognize brand as a key driver of buying a second-hand product (See figure 2).

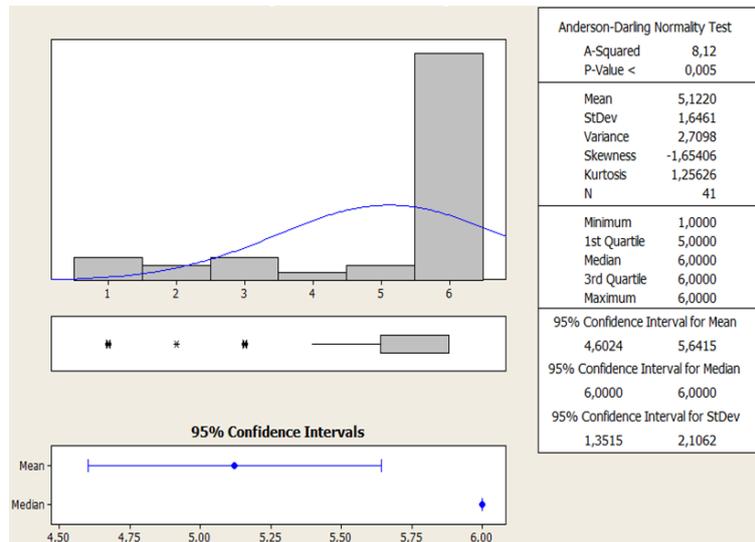


Fig. 2 – Summary for Brand Recognition Level Results. Source: own research

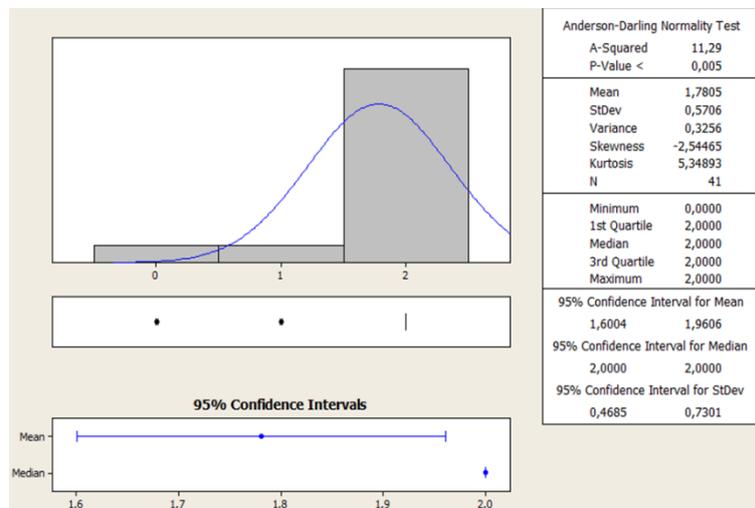


Fig. 3 – Summary for Buying Status Results. Source: own research

Again, with respect to customers' (students) willingness to purchase a second-hand product/brand, the mean score of the participants is 1.78 across a range of 2 (See Figure 3), indicating a higher number of customers having interest in the brand when selecting a used-product to buy.

In order to obtain a detailed idea about our research, we made a quick observation of our regression analysis results with Excel Regression Tool 2016. The R square value explains how much the independent variable (brand popularity) with the power of %55.92 predicting the dependent variable (buying a second-hand product). Regarding the threshold of R2, if the R square result is higher than 0.5, it indicates a strong predictor of the independent variable. Per the ANOVA test, the result of our research, F and P values are lower than 0.05, showing that there is a significant effect of brand popularity on customers' intent to select a second-hand product. In order to increase the reliability of our research, we further performed chi-square test to ascertain whether there is a statistically significant difference between the expected frequencies and the observed frequencies. Our estimates (see Table 2), indicate a statistically significant with respect to the sample size used. Based on the Chi-Square Test results, P-value of our hypothesis is 0.000 and is less than 0.05 (i.e. significant level). Again, with Fisher's Exact Test (F), our analysis shows a significance value as well.

Tab. 1 – Regression Analysis Summary Output (Model Summary and ANOVA Test for Regression Results).

Source: own research

Regression Statistic						
Multiple R	0,747816125					
R Square	0,559228957					
Adjusted R Square	0,547927135					
Standart Error	1,106800435					
Observation	41					
ANOVA						
	df	SS	MS	F	Significant F	
Regression	1	60,614963	60,614963	49,48131152	0,0000000192	
Residual	39	47,7752809	1,225007203			
Total	40	108,3902439				
	Coeffienct	Standart Error	t Stat	P-value	Lower %95	Upper %95
Intercept	1,280898876	0,572752128	2,236393047	0,031117883	0,122398348	2,439399405
Square Feet (X)	2,157303371	0,306683648	7,034295382	0,0000000192	1,53697714	2,777629601

Tab. 2 – Chi-Square Tests Regression Results. Source: own research

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44,775 <sup>a</sup>	10	,000
Likelihood Ratio	32,044	10	,000
Linear-by-Linear Association	22,369	1	,000
N of Valid Cases	41		

a. 17 cells (94,4%) have expected count less than 5. The minimum expected count is ,07.

However, from a total of forty-one participants, we undertook a Cross Tabulation to examine the pattern of responses per the 6-point Likert scale used to evaluate the independent variable (brand recognition/popularity). Based on the Cross Tabulation, we found that 30 respondents believed that “strongly known brand” influences their willingness to buy second-hand products. Whereas, the scale: “weak known brand” has no respondent willing to buy such a brand (See Table 3). This suggests that there is a positive relationship between a strong brand and the willingness to buy a second-hand product.

Tab. 3 – Crosstabulation Table. Source: own research

		Buying Status			Total
		Unwilling to buy second-hand products	Neutral	Willing to buy second-hand products	
Brand Recognition Level	Strongly Weak Known	2	1	0	3
	Weak Known	0	0	2	2
	Lower Middle Known	1	1	1	3
	Middle Known	0	1	0	1
	Upper Middle Known	0	0	2	2
	Strongly Known	0	0	30	30
Total		3	3	35	41

## 5 CONCLUSION

The research sought to draw attention to second-hand retailers by exploring how brand plays a key role in consumers’ buying decision regarding used-product. In view of this, the ultimate goal of this paper was to perform an empirical on the impact of brand popularity on consumers buying decision of a used-product. Using a pilot study, forty-one international students of

Tomas Bata University in the Czech Republic took part in the study. With a descriptive analysis and ANOVA, there was a significant relationship between brand popularity and the buying of second-hand product among consumers. The practical implication of this research offered a conceptual model to marketers and dealers in the used-product retail market on how best they could re-consider their branding strategy to win customers. Notwithstanding, marketers, per the authors knowledge, should considered brand as a communicating tool to initiate product-customer contact. Again, the general idea from this study would strengthen marketers' views on brand as they considered branding as the process of translating the image of a product brand into the minds of customers. Additionally, the study would provide more insights to brand managers and their partners to improve more regarding the effectiveness brand strategies. In theory, the study adds up to the previous study by widening the concept of consumer behaviour and brand management in the retail market, specifically, the second-hand product market. At the same time, the study gives deeper understanding about the interconnection between the brand popularity, second-hand retail market, and the purchasing decision of consumers.

The study is constrained by some limitations. First, the study is a pilot one, so the results may not reflect the entire behaviour of customers. Second, it considered only students who are mostly described as low-income earners while the middle-income class had been ignored. Lastly, only one aspect of brand attributes: brand popularity, was examined in this survey. We therefore recommend that future study could take care of the aforementioned limitations outlined above.

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# Appendix

Table made for explaining to Data Comprehension Index Coding based on articles Graen & Uhl-Bien (1995) and Naktiyok & Kula (2018) for examining the determining of positive-negative relationships between depended and independent variables.

Data Comprehension Index Coding			
Brand Recognition Level			
1: Strongly Weak Known	Just one brands selected. The rest of them unselected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
2: Weak Known	Just two brands selected. The rest of them unselected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
3: Lower Middle Known	Just three brand unselected. The rest of them selected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
4: Middle Known	Just two brand unselected. The rest of them selected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
5: Upper Middle Known	Just one brand unselected. The rest of them selected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
6: Strongly Known	All Brands Selected	(Apple Inc. (Technology Company), Zara (Textile brand of Inditex Group), BMW (Automobile Company), Samsung (Technology Company), Calvin Klein Inc. (Moda Company), Mercedes-Benz (Automobile Company))	
Willingness to Buying Status			
Likert-Scale Results	A-B Case Study	Likert-Scale Results	
0: Unwilling to buy second-hand products	0	1: Very Strong Weak 2: Neutral 4: Strong 5: Very Strong There are 4 question based on Likert-Scale If all questions averages above to 1.2, coded as 1 If all questions averages below to 1.2, coded as 0	The 4 questions in this section are linked to each other. So average was chosen as the key indicator.
1: Neutral	1	0: Average > 1.2 If all questions averages below to 1.2, coded as 0	
1: Neutral	0	A-B Case Study A: Unknown Brand - Well-Known Brand There are 6 question based on A-B Case Study If 4 and more question selected as B, coded as 1 If less than 4 question selected as B, coded as 0	The 6 questions in this section are linked to each other. So more than 4, B answers were chosen as the key indicator.
2: Willing to buy second-hand products	1	1: 4 and more than answers B 0: less than 4 answers B	
The answers to this binary section are proof for each other (There are the control points for each other). So the relationship between the answers was made as a mathematical equation.			

# ROLE OF THE BUSINESS MODELS IN THE INDUSTRY 4.0 – THE LITERARY RESEARCH

*Nikola Janíčková, Petra Domanířová*

## **Abstract**

This article aims to conduct literature research not only in the field of the fourth industrial revolution and its position in the Czech Republic, but also to determine the role and possibilities of using business models in Industry 4.0. The primary business model that our research will be focused on is the Canvas model. The research methodology is based on a comparison of research by other authors with a focus on Industry 4.0 in the Czech Republic and worldwide, on the role of business models in this sector and their interconnection. The main results of this research point to the importance of Industry 4.0 and its implementation, as well as the need to adapt business models to the needs of this revolution.

*Keywords: Industry 4.0, business model, the Canvas model, the Czech Republic, the fourth industrial revolution*

## **1 INTRODUCTION**

One of the biggest challenges of Czech industry is the ongoing fourth industrial revolution (I4.0), which affects not only the Czech business environment but also the whole world. The reason for I4.0 is the effort of developed countries to maintain competitiveness in the field of technological leadership. Mařík (2016) says: “The fourth industrial revolution does not bring fundamental changes only in the field of industrial production. Although it is the centre of its attention, as it is best prepared for the necessary and natural changes, the scope of the Fourth Industrial Revolution is much wider. It is a completely new philosophy bringing societal change and spanning several areas from industry, through technical standardisation, security, education system, legal framework, science and research to the labour market or social system.” As for the Czech Republic, this revolution has already begun and is estimated to last another 10-30 years (Confederation of Industry of the Czech Republic, 2019).

Industry 4.0 as such unifies the physical, information and data components not only of the production environment itself. It connects machines, storage and logistics systems and other technological components into one unit. An entirely digitised automated system brings significant improvements to all business processes. At the heart of this concept is the so-called "Smart Factory". This is a critical element of the transition to a digitised and automated whole. It can autonomously manage and at the same time streamline the complete production process. The Czech concept of I4.0 is broader than the world concept. It is not just a Smart Factory, but a digital environment into which the company is gradually transforming. The Czech concept focuses more on the customer and a smart product or service. (Confederation of Industry of the Czech Republic, 2019)

In the summer of 2019, a survey was conducted, which included 105 Czech companies. In this survey, the manufacturing industry was represented in 59%, where 50 large enterprises (more than 250 employees), 31 medium-sized enterprises (50-250 employees) and 24 small enterprises (less than 50 employees) answered questions about the readiness and implementation of Industry 4.0. This survey showed that most companies have 5% of their budget allocated to activities related to Industry 4.0, and this survey also showed that large companies are more active in this regard. Companies in the Czech Republic are aware of the

benefits that digitisation, communication between systems and devices and the flow of data to the company in real-time bring them. "Two-thirds of respondents said they had invested in elements of Industry 4.0 because it is important for their future. It is quite surprising that only 8.6% of companies feel external pressure to implement Industry 4.0 applications, whether from parent companies or customers.", comments Jiří Holoubek, a member of the board of the Confederation of Industry. It is generally stated that it is large companies, especially from the automotive industry, that should push their suppliers into the digital transformation. "However, only 36 per cent of companies have developed a digital strategy, and in most of the implemented projects, it is probably more of a non-systematic implementation of isolated partial solutions. It continues to be confirmed that small and medium-sized enterprises, in particular, need more support in understanding the benefits of digital technologies and their subsequent deployment. Most often, companies invest in elements of Industry 4.0 to increase productivity per employee (56.2%), reduce unit costs (43.8%) and optimise the use of production capacity (41%). For large companies, the motive for reducing costs prevails. Small and medium-sized companies are mainly trying to increase productivity by investing in digital transformation. The experience of companies so far shows that most of their expectations associated with these investments have been entirely or at least partially met. Half of the companies want to increase investment in this area in the next five years. (Confederation of Industry of the Czech Republic, 2020)

The introduction of elements of Industry 4.0 into every business requires thorough preparation of all companies. This preparation begins with the company's strategy, which often needs to be reformulated according to the needs of the new era of digitisation. This is also related to the adaptation of all company activities, relationships and processes. An integral part of the management and planning of these activities is the creation of business models that create a description of the process or approach to creating corporate value. The business model as such has no, generally accepted definition, but in a real environment, it is used by every company. In the simplified interpretation, the business model describes what the company's revenues flow or will flow from. For example, Osterwalder, Pigneur and Clark (2010) present their definition, which identifies business models, as a comprehensive description of the principles of creating, delivering, and capturing value in business. Hedman and Kalling (2003) define a business model as an accurate description of the critical components<sup>3</sup> of corporate business. Furthermore, Magretta (2002) describes business models as stories explaining how firms work.

One of the best known and most widely used business models is the Canvas model, which translates as "business plan scheme". This model was designed by Alexander Osterwalder, an entrepreneur and innovator in business models. It is an alternative to a large business plan and can be easily and relatively quickly changed and adapted to current conditions. The Canvas graphic scheme can be divided into the left side, which identifies the product, and the right side, which deals with the market (Maurya, 2010). It consists of nine main parts, the so-called stones, focusing on specific aspects of the business (Štrach, 2009). Facilitating communication was an essential factor, as this model was intended to motivate the people who dealt with it to think differently about the way they do business (Osterwalder, 2004). Over 5 million users use this model, and the book in which this model is described has been translated into thirty world languages and has sold over a million copies (Osterwalder, 2014). This business model is used by many companies around the world, mainly due to the simplicity of its creation and possible changes.

The Canvas model, therefore, appears to be one of the most suitable business models for modification to the needs of Industry 4.0. This statement will be confirmed when mapping the area of knowledge of this topic.

This article is focused on the level of knowledge of the fourth industrial revolution and the related knowledge about business models, their modifications and uses in I4.0 and on finding a gap in this area. The outputs of this article will be used as literature research for a junior project, which will focus on identifying key performance indicators according to their specification and relevance in individual areas of the Canvas model for the needs of manufacturing in the Czech Republic, where Industry 4.0 is already evident.

This article is divided into several primary sections. Section 1 is the introduction to the researched issue; section 2 shows the theoretical background of the research, that means the literature research, devoted to this topic, section 3 describes the research methodology. Section 4 provides a final overview of the results and finds a gap in knowledge, and section 5 summarises the main conclusions of the whole article.

## **2 THEORETICAL BACKGROUND**

This chapter will outline the theoretical background of future research. The individual concepts and the current state of knowledge in individual areas of research will be explained.

### **Industry 4.0**

Industry 4.0 is the current trend of digitisation, which is related to changes in the labour market and, among other things, the automation of production. This concept was first presented in 2013 at the Hanover trade fair. However, the primary vision of this revolution arose in 2011. Companies are gradually penetrating this trend and trying to create new strategies in which Industry 4.0 includes and adjust their business processes accordingly. The introduction of Industry 4.0 helps companies maintain their competitiveness while innovating their established practices. Large companies, mainly from the manufacturing and automotive industries, first began to penetrate this trend, but now medium-sized and small companies and other industries are already dealing with this concept. In the Czech Republic, the government approved the Industry 4.0 Initiative in 2016. This initiative was created by the Ministry of Industry and Trade and aimed to show possible directions for development and outline measures that could not only support the Czech economy and industrial base but also help prepare the whole society. To absorb this technological change. The initiative contains the necessary information on the need for urgent changes caused by the onset of the 4th Industrial Revolution and maps measures to support investment, applied research and standardisation and addresses issues related to cybersecurity, logistics and legislation. (Ministry of Industry and Trade, 2016)

Raj et al. (2019) identified fifteen barriers to the introduction of Industry 4.0 technologies through interviews with industry experts and analysis of results using the DEMATEL method. Their research has been very beneficial and has been conducted worldwide. The following barriers were identified: high investment in Industry 4.0 implementation, lack of clarity regarding economic benefits, challenges in value-chain integration, risk of security breaches, the low maturity level of preferred technology, inequality, disruption to an existing job, lack of standards, regulations and forms of certification, lack of infrastructure, lack of digital skills, challenges in ensuring data quality, lack of internal digital culture and training, resistance to change, ineffective change management and lack of digital strategy alongside resource scarcity. All these barriers must be overcome by any company that decides to implement Industry 4.0, so it is essential that companies know how to overcome these obstacles and are prepared for them. (Raj et al., 2019)

There is currently a lot of research dealing with Industry 4.0, but there are significant limitations. Castelo-Branco, Cruz-Jesus and Oliveira (2019) identify the factors that characterise Industry 4.0 in manufacturing across the European Union. This research has great

potential, but the authors have struggled with significant limitations in terms of data acquisition, so their results are based only on Eurostat data and are very skewed. In contrast, Jabbour et al. (2018) focused their research on linking Industry 4.0 with environmentally friendly production. This innovative approach has been a great success. To create the connection, the authors defined critical success factors, which are management leadership, readiness for organisational change, top management commitment, strategic alignment, training and capacity building, empowerment, teamwork and the implementation team, organisational culture, communication, project management, national culture and regional differences (Jabbour et al., 2018). They created a guide to what companies should focus on in this connection and significantly contributed to the level of knowledge in these areas. The work of Frank et al. (2019), which combines customer-oriented servitisation and manufacturing process-oriented Industry 4.0, is also exciting. They consider added value to be a key indicator and create interconnections with the help of the business model concept (Frank et al., 2019). Furthermore, this is where the critical role of business models in the introduction of Industry 4.0 is already beginning to show.

**The role of business models in Industry 4.0**

The role of business models in Industry 4.0 is significant. Every company has a business model and uses it to manage its processes. Therefore, when introducing Industry 4.0, it is first necessary to modify the business model to meet the requirements of the Fourth Industrial Revolution. Many studies from around the world confirm this step and its importance. Man and Strandhagen (2017) explore how to use business models in Industry 4.0 successfully. The authors created a scheme that connects sustainability and Industry 4.0 to the business model (Man & Strandhagen, 2017). This diagram shows the following figure.

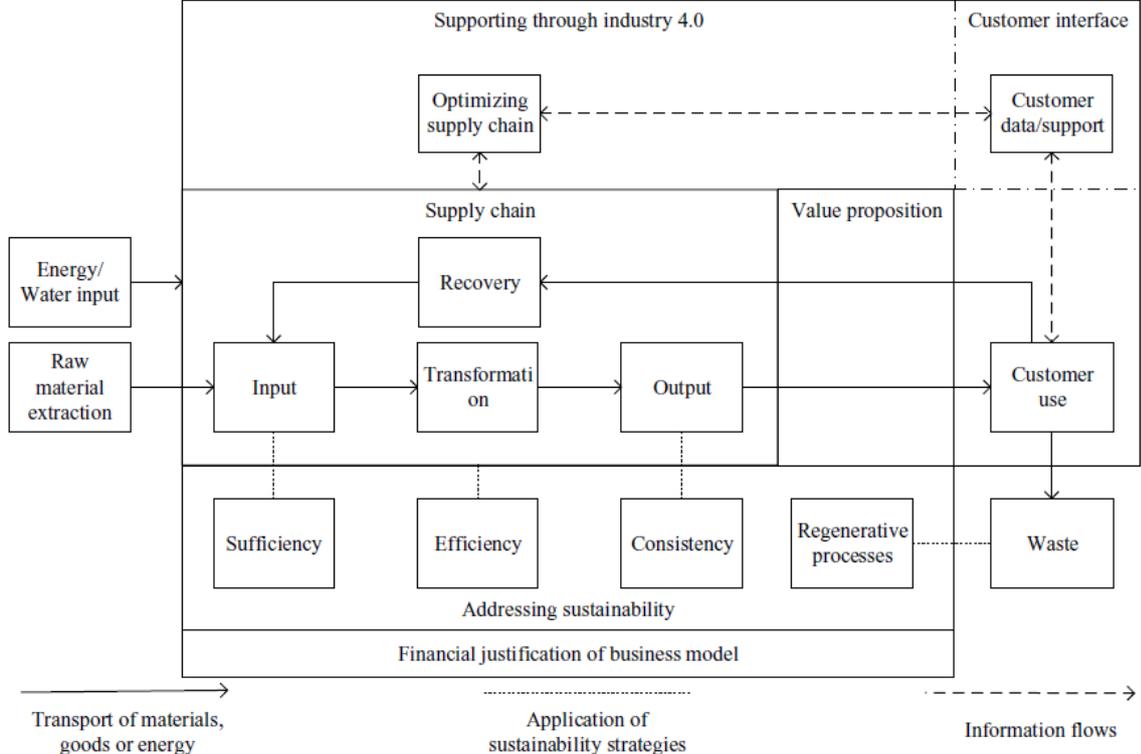


Fig. 1 – Connecting sustainability and Industry 4.0 to the business model. Source: Man & Strandhagen (2017)

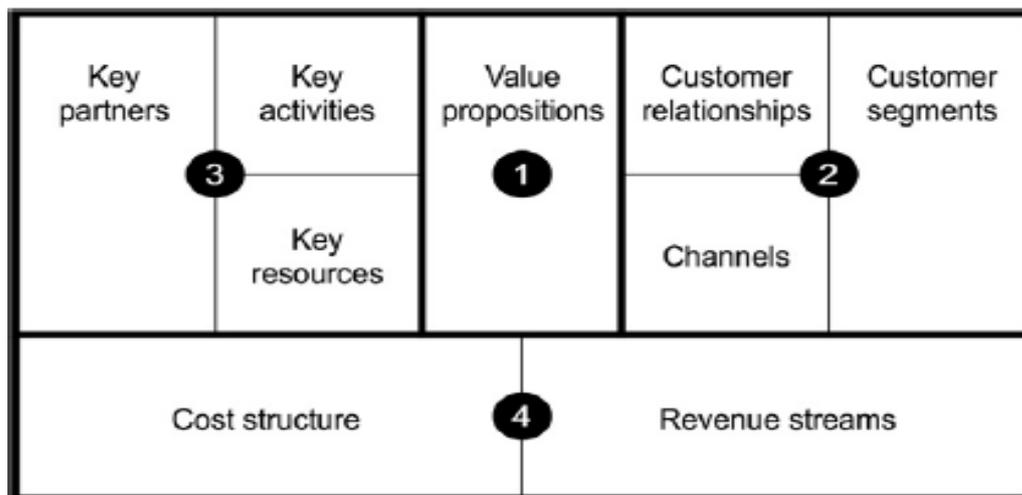
Müller, Buliga and Voigt (2020) in their study, they examine the role of absorptive capacity and innovation strategies in Industry 4.0 business models. They focus on comparing large companies with small and medium-sized enterprises. They suggest that small and medium-sized enterprises should consider the potential of novelty-centered business models (Müller,

Buliga & Voigt, 2020). Ibarra, Ganzarain and Igartua (2018) focus on the factors that affect business models in Industry 4.0 the most. Based on this research, they defined the three most important aspects, which are services, Internet ecosystems, and customer focus, thus deepening knowledge in this area.

In contrast, Härting et al. (2019) focused their study on the factors that influence the new digitised business models, those models that are already modified for Industry 4.0. They defined four factors, which are individualisation, efficiency, communication and key performance indicators. They found that key performance indicators positively influence these business models and, at the same time, the performance of the organisation. Moreover, it is for this reason that crucial research indicators, namely their identification in the Canvas model, will be the focus of future research, which aims to deepen knowledge in this area. Weking et al. (2019) on the contrary, they focused their study directly on business models in Industry 4.0 and their modifications. The authors selected four business models for their study, one of which is the best-known Canvas business model (Weking et al., 2019). This model, in conjunction with Industry 4.0, is the subject of a myriad of studies that prove that this model is probably one of the most suitable models for modification to Industry 4.0. For these reasons, our future research will focus directly on the Canvas model. These claims can be substantiated, for example, by studies by Pfohl, Yahsi and Kurnaz (2017), who examine the concept of how technological innovations related to Industry 4.0 are dispersed into the supply chain. They use the Canvas model for this study. As another study on this topic, we can mention the work of Rübel et al. (2018), whose use the Canvas model and directly modify it into Industry 4.0 and thus create a framework for optimisation.

### The business model Canvas

The Canvas business model is one of the most used models. It is used mainly in the automotive and manufacturing industries and is also very suitable for modification for the needs of Industry 4.0. This model consists of nine main areas, which are shown in the following figure.



Note: 1 = Product; 2 = Customer interface; 3 = Infrastructure management; and 4 = Financial aspects.

Fig. 2 – Conceptual representation of business model Canvas. Source: Osterwalder (2004)

The study by Joyce and Paquin (2016) deals with this model and extends the original business model canvas by adding two layers: an environmental layer based on a lifecycle perspective and a social layer based on a stakeholder perspective. This paper presents the triple-layer business model canvas tool and describes its key features through a re-analysis of the Nestlé

Nespresso business model. This new tool contributes to sustainable business model research by providing a design tool which structures sustainability issues in business model innovation (Joyce & Paquin, 2016). Keane, Cormican and Sheahan et al. (2018) conduct a study comparing how entrepreneurs and managers represent the elements of the canvas. The results of this exploratory study suggest that entrepreneurs and managers may represent the nine business model canvas elements by two factors, but that the two groups may represent the elements in a different way (Keane, Cormican & Sheahan, 2018).

In contrast, Kühn et al. (2018) based on specific use cases illustrate the typical approach in defining analytics projects by using Canvas. The last study that we consider essential to mention is Schmidtke, which in her study suggests that a module like the Canvas is a fundamental component for any model of cognition and of crucial importance to understanding the origin of higher cognitive abilities, such as language or geometry (Schmidtke, 2018). All these studies prove that the Canvas model is a much-discussed topic in the business world.

### **3 METHODOLOGY**

The following chapter describes the research process of a systematic evidence-based revision strategy. This research was supported by three books related to the topic of Industry 4.0 in the Czech Republic, business models and managerial processes related to this. The first book is "Industry 4.0 - A challenge for the Czech Republic" by Vladimír Mařík (2016) and the second book is "Business model generation: A handbook for visionaries, game-changers, and challengers." Osterwalder et al. (2010). The third book is "International Management", written by Pavel Štrach (2009). These books provide a general framework that expands and deepens the knowledge of the researched topic.

The research was limited to articles from key peer-reviewed journals that publish most of the research on economics, and conference papers that were published in proceedings. The search was limited to the period from the beginning of 2016 through the presence in 2020. A narrower time frame was chosen because of monitoring a relatively new topic and the related effort to provide the most up-to-date information and knowledge. Research in this area is prevalent and discussions and new topics are continually opening up. Each author understands the concept of I4.0; differently, so many opinions agree and diverge in many ways.

The search was performed in the Proquest Central database, which provides information for more than 160 disciplines, including business and economics or science and technology, in Business Source Complete database (EBSCO), which provides full-text periodicals, peer-reviewed periodicals, news and conference proceedings and much more. In the Web of Science citation database, which includes both tracking of scientific citations and regularly updated bibliographic information. The relevance of the articles was ensured by reading all the abstracts and checking the discussion regarding the goals of future research.

In the end, those articles were selected that seemed to be the most important for the researched issues and future use in future research. However, due to the broad topic of the junior project, this literature search will later be expanded to include the main focus on the Canvas business model and the subsequent use of key performance indicators in Industry 4.0 in this business model.

### **4 RESULTS**

Literary research divides articles into three primary groups. The first group of articles is focused only on the Industry 4.0, the second group of articles is focused on the role of business models

in the Industry 4.0 and the last group is focused on combination both of them and the using the Canvas business model. The main outputs of used articles are listed in the tables below.

Tab. 1 – Approaches of articles based on the literature review. Source: own research

<b>Authors</b>	<b>The principles of articles focused on Industry 4.0 – an overview</b>
<b>Raj et al., (2019)</b>	They have compiled a list of fifteen significant barriers that prevent all companies from implementing Industry 4.0 technologies.
<b>Castelo-Branco et al., (2019)</b>	It measures the factors that characterise Industry 4.0 in manufacturing. They focus on the whole of Europe.
<b>Authors</b>	<b>The principles of articles focused on the role of business models in the Industry 4.0 – An overview</b>
<b>Weking et al., (2019)</b>	They examine business models in Industry 4.0 and their modifications. They identified three super-patterns and 10 sub-patterns of I4.0 business models. The super-pattern integration innovates its business model around new processes, servitization around new product and expertization around a hybrid of products and processes.
<b>Härting et al., (2019)</b>	They identify the factors that influence the new digitised business models in Industry 4.0. These factors are key performance indicators, individualisation, efficiency and communication.
<b>Ibarra, Ganzarain &amp; Igartua (2018)</b>	They identified three essential aspects that affect business models in Industry 4.0. These aspects are services, Internet ecosystems and customer focus.
<b>Authors</b>	<b>The principles of articles focused on the Canvas business model – An overview</b>
<b>Joyce &amp; Paquin, (2016)</b>	They present the triple-layer business model Canvas tool and describes its key features through a re-analysis of the Nestlé Nespresso business model.
<b>Rübel et al., (2018)</b>	They combine industry 4.0, business model and business model management aspect as an organisations potential. And results in increasingly competitive and operational success. They modify the Canvas business model into Industry 4.0 to create an optimisation framework.

The most important results of the literature search, shown in the table above, prove a high interest in the monitored topic. Based on a literature search, a gap in knowledge was found, which we would like to fill in the following research.

There is much research in these areas that looks at the Canvas business model, Industry 4.0, or the identification of key performance indicators in selected companies or entire industry sectors. The most advanced research links various business models with Industry 4.0 and seeks to modify them into so-called maturity models or, conversely, create a concept of linking key performance indicators and strategic business models. Exciting are the researches of the Canadian and Spanish universities, where the authors in the first research performed a semi-automatic assignment of key performance indicators to the strategic business model. The other research focuses on composite indicators of strategic business models that support evaluation and decision-making. The aim is to create techniques and algorithms for deriving the values of these indicators in models (Maté, Trujillo & Mylopoulos, 2012; Barone et al., 2011). However, the neglect of views on the Czech business environment is widespread.

In this respect, we see a gap in knowledge, and we want to use existing research and the level of understanding of these areas and conduct research on identifying key performance indicators in the Canvas business model in the Czech business environment for the manufacturing industry in the new 4.0 era.

## 5 DISCUSSION

Due to the breadth of the researched topic, there are many topics to discuss. Industry 4.0 concept has already penetrated some industries. As for the Czech Republic, the automotive and manufacturing industries are the best. Even there, however, companies are just beginning to work with the new concept, eliminating shortcomings and trying to meet the implementation of this system with as few obstacles as possible. Among other things, many other industries are not yet so far in implementing Industry 4.0 and need help with system modifications that will be tailored to their industry. All the knowledge that we know so far becomes with a certain degree of superficiality, and therefore it is important to focus research more in-depth on these topics and to expand knowledge in this area with greater detail.

## 6 CONCLUSION

The outcoming research will take place by the end of February 2021. This literary research will be followed by a more in-depth focus on the Canvas business model in the manufacturing industry, where the fourth industrial revolution is already taking place. Subsequently, key performance indicators will be identified according to their relevance and specification in the Canvas model, which is used in the manufacturing Industry 4.0. The last step of the prepared research is the modification of this goal into the Czech business environment.

This research will make it easier for many companies to implement Industry 4.0 and can deepen their scientific knowledge in this field. This connection will expand, simplify and improve the ability of companies operating in the manufacturing industry and at the same time in the Czech business environment to implement the concept of Industry 4.0 This research will combine several methods that will provide many companies of this type industrial revolution.

Assuming that the research and its goals are successfully met, it can be expected that this system will be used by Czech entrepreneurs, to whom it can significantly help in their activities.

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# LITERATURE REVIEW OF FUNDAMENTAL AND TECHNICAL INDICATORS PREDICTION OF FINANCIAL MARKET USING ARTIFICIAL INTELLIGENCE TECHNIQUE

*Zuzana Janková*

## **Abstract**

The stock market plays a key role in national economies. The goal of every investor is to maximize the return and minimize the risk arising from the investment. As a result, many studies have been conducted to predict stock market developments using indicators derived from classical stock market analyses - fundamental and technical through methods and means of artificial intelligence and others. This study attempted to conduct a systematic and critical literature review of 40 articles and contributions from relevant research and scientific papers indexed in world databases. The results revealed the most common fundamental and technical indicators that serve as inputs to artificial intelligence models with a focus on fuzzy logic, neural networks or hybrid models.

*Keywords: artificial intelligence, fuzzy logic, fundamental analysis, hybrid system, neural networks, stock market, technical analysis*

## **1 INTRODUCTION**

Financial markets are an integral part of all national economies. According to Billah, Waheed and Hanifa (2016), this is actually the most important way to raise capital. It is a great challenge for financial analysts, traders and brokers to determine the best time to buy or sell financial instruments in order to obtain the expected return, given the risk that investors take when spending their funds. The original theories and models use assumptions that simplify the solution, but in practice can cause significant problems. Rajab and Sharm (2019) state that forecasting prices is a complicated and difficult task due to chaotic behaviour and a high level of uncertainty in the prices of financial instruments in the market. In this area, the design of a highly accurate, simple and comprehensible prediction model is of the utmost importance. Chen et al. (2016) further state that there are numerous factors that potentially affect the prices of financial instruments that need to be considered. Every trader tries to make his own forecasts, either subjectively, i.e. through models based on their personal feelings and experiences, or objectively using different types of indicators.

Although a number of techniques have been developed to improve stock index forecasts, there is still no one-size-fits-all model for different types of data and applications. Even a slight improvement in the accuracy of the forecast can bring investors a significantly higher return. Recently, a large amount of research and scientific work has been published looking for optimal forecast models for financial markets. Most forecast research uses statistical methods of time series analysis. However, these models are severely limited, especially with regard to seasonal and non-linear uncertainty issues. It is reasonable to assume that because data on the prices of financial instruments are influenced by deterministic and random factors, stock market forecasting can only be successful using tools and techniques that can overcome the problem of price uncertainty, noise and non-linearity. These problems, along with other shortcomings of traditional methods, have led to a growing interest in artificial intelligence methods, including artificial neural networks, fuzzy logic, or hybrid neuro-fuzzy systems.

## 2 ANALYSIS AND DISCUSSION OF LITERATURE BACKGROUND

### Analysis of fundamental analysis indicators

Fundamental analysis is considered to be the most comprehensive type of stock analysis. It assumes that the intrinsic value (theoretical price) of a stock differs from its current market value (exchange rate) at which it is traded on public markets. If the intrinsic value of a stock is higher than its price, it is considered undervalued; if it is lower, it is considered overvalued. In order to correctly determine the intrinsic value of stocks, analysts and investors perform various calculations. These differ from each other both in the methods used and in the individually substituted values of the variables, which is due to the diversity of information and data at their disposal. From the point of view of the nature of the examined factors, the fundamental stock analysis can be divided into three types, namely macroeconomic, sectoral and analysis of individual joint-stock companies and their shares.

The fundamental analysis is focused on the evaluation of the individual price of the company's stock titles based on the company's past performance. The analyst studies anything that affects the company's stock prices, including the company's profits, the state of the company's macroeconomic factors, such as the overall economy, industrial conditions and corporate governance. If a particular stock is undervalued and the company's fundamentals are strong, then this means that investors will be signalled to buy. If the value of the shares is overvalued and the fundamentals of the shares are weak, then this indicates signals of a sale to investors, as described by Chourmouziadis and Chatzoglou (2016).

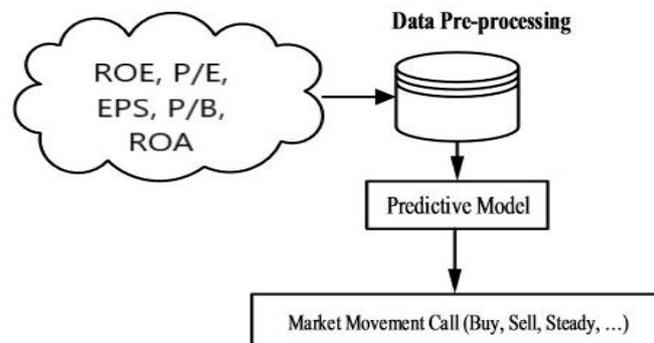


Fig. 1 – Fundamental analysis approach. Source: Nti, Adekoya & Weyori (2019)

Due to the unstructured nature of fundamental factors, it is difficult to automate fundamental analysis. On the other hand, the development of machine learning and artificial intelligence has allowed scientists to automate stock market prediction based on unstructured data, which in some cases has shown higher prediction accuracy. Important scientific and research works include, for example, Dutta, Bandopadhyay and Sengupta (2012), who demonstrated the usefulness of fundamental analysis using financial indicators to separate more profitable instruments from less profitable ones. The authors compared their annual yield with the benchmark with an accuracy of 74.6%. This is one of the few documents that focuses on the use of company-specific fundamentals to identify stocks for investment. The experimental results of Lam (2004) show that neural networks using financial data for 1 year or more consistently and significantly exceed the minimum reference value, but not the maximum reference value. For neural networks with both financial and macroeconomic predictors, they do not exceed the minimum or maximum reference value in this study. Thawornwong and Enke (2004) predicted the S&P 500 stock index using financial and macroeconomic indicators. The results show that neural network models, especially those that use adaptive relevant variables, generate higher returns with lower risks than buy-and-hold strategies, conventional linear

regression, and unified neural network models that use constant relevant variables. However, the authors further add that in reality, the benefit obtained from neural network forecasts was probably lower when transaction costs were considered. In addition, training in neural networks is usually not very stable. Training is also computationally expensive in terms of training times used to determine the appropriate network structure. The success rate can therefore vary from one workout to another. Although the neural networks of the portfolio bring impressive results, however, these benefits can be derived at the expense of exposing investors to higher computational risk. Enke, Grauer and Mehdiyev (2011) in their article introduced a three-phase stock market prediction system. In the first phase, a multidimensional regression analysis is used to define economic and financial variables that have a strong relationship to the stock market. In the second phase, type-2 fuzzy clustering based on differential evolution is implemented to create a prediction model. For the third phase, they are used by a type-2 fuzzy neural network to justify future stock price predictions. The results of the network simulation show that the proposed model surpasses traditional models for predicting stock market prices. Recently, Sheta, Ahmed and Faris (2015) used machine learning and presented an algorithm for predicting the S&P 500 market index. They selected 27 financial variables each week and found a relationship between stock indices and these variables. They compared three different techniques: regression, artificial neural networks, machine learning, and stated that machine learning contributes to better predictions compared to the other two models.

### Analysis of technical analysis indicators

Fundamental analysis is only able to indicate the direction of the market in general, for the right timing it is necessary to choose technical analysis. The technical analysis is based on the study of supply and demand and uses mainly prices and trade volume. It is based on the historical development of prices, which is most likely to be repeated in the future. This means that people remember what happened in the market some time ago and use it to buy and sell in the future. Technical analysis does not attempt to measure titles by tracking the company's financial data. Several methods have been developed to detect trading signals, among which artificial intelligence methods are attracting more and more attention from investors and researchers, as described by Chen and Hao (2018).

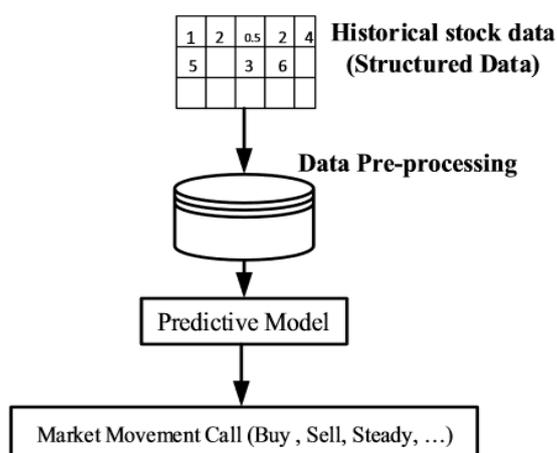


Fig. 2 – Technical analysis approach. Source: Nti, Adekoya & Weyori (2019)

Technical indicators are mathematical calculations based on basic trading data on shares. They have been said to have rich and hidden information about stock markets. Some indicators of technical analysis contain information on the same day, but also information on previous days, as reported by Gao and Chai (2018). Technical analysis is one of the primary analytical approaches that many investors use to make investment decisions in order to increase their

investment returns. The technical analysis considers historical data on financial markets and uses charts as the primary tools to predict price trends and investment decisions.

Most stock market prediction methods typically use technical analysis indicators to predict future stock trends. However, the combination of different techniques of technical analysis is a difficult task and requires decisions through subjective evaluations, as pointed out by Dymova, Sevastianov and Bartosiewicz (2010). According to Majhi, Panda and Sahoo (2009), some techniques may provide conflicting results, the evaluation of which requires specific human expertise, subjective evaluation and appropriate justification. It is common practice to use many technical indicators and combine them in order to achieve good performance through different ways of analysing price movements. However, each technical indicator has been developed for specific purposes, expresses different and uneven characteristics, and it is therefore doubtful whether any combination of them can work. Their careful selection ensures that their properties will be cumulative, otherwise the combination of different technical indicators may cause erroneous results, as the indicators may negate each other, as reported by Chourmouziadis and Chatzoglou (2016).

Dourra and Siy (2002) argued that technical analysis mixes very well with a number of artificial intelligence techniques. Vaidehi et al. (2008) proposed a fuzzy system that predicts the possibility of an increase or decrease in market prices with almost 80% accuracy, by combining a subtractive clustering algorithm and a fuzzy system. Ijegwa et al. (2014) used four technical indicators as inputs and developed a fuzzy system that emits a buy, sell or hold signal with satisfactory results. However, each system should use technical indicators with similar characteristics in order to enhance the output and avoid conflicts. Therefore, the idea of using a large number of indicators could end up in a system that produces inconsistent signals. If the evaluation time is short, the signals may seem satisfactory, although the results may be the opposite in a different or longer period. Kara, Boyacioglu and Baykan (2011) used artificial neural networks to predict the Istanbul Stock Exchange. They used ten technical indicators as inputs to their networks. The results showed that the ANN models were remarkably better than other models. Bekiros (2010) introduced a hybrid neuro-fuzzy system that uses technical analysis for 10 of the most important stock indices in the US, Europe and Southeast Asia. Overall gains based on the neuro-fuzzy system have been shown to be better than a repetitive neural network. Atsalakis and Valavanis (2009) also propose a neuro-fuzzy system consisting of an adaptive neuro-fuzzy inference system (ANFIS) and a stock market process model with technical analysis to suggest the best next day stock trend prediction. Similarly, Agrawal, Jindal and Pillai (2010) introduced an innovative approach to implementing stock market decisions by minimizing investment risk. They used an adaptive neuro-fuzzy inference system (ANFIS) for decision-making based on technical indicators. In his study, Chandar (2017) proposed four technical indicators. These variables are used as inputs to a neuro-fuzzy system to predict daily stock prices. This study also compares the proposed work with the ANFIS training method and the subtractive clustering method, etc. Based on the results of the simulation, it was found that the average performance of the neuro-fuzzy approach based on cluster reading is much better.

### **3 METHODOLOGY**

This conceptual document is based exclusively on reviews and analysis of research and data from related literature. Several methods were used to collect and analyse the literature. This study is based entirely on qualitative research; The researcher decided to adopt his document analysis methodology as a research technique to achieve the main goal of the study, which is to systematically examine appropriate indicators based on fundamental and technical stock analysis to predict the stock market based primarily on artificial intelligence methods.

## Research Framework

This study uses a thorough analysis of the existing literature focused mainly on the studied topic of stock market prediction primarily through artificial intelligence methods, or similar methods based on input parameters based on fundamental and technical stock analysis. A systematic survey of past articles (journals from journals and conferences) and books (chapter books) was used to monitor contemporary works, which are mostly indexed in a reputable database such as WoS, Scopus, EBSCO, Google Scholar, etc. The aim of this study. The reason for this selected technique (document and content analysis) is to assess the above variables entering mainly into artificial intelligence models. In addition, this approach is polarized from previous scientists' perceptions of the consistency and inconsistencies that have appeared in the literature. This procedure therefore gives the author a proper advantage in finding relationships and patterns across a number of related articles, considering the current focus of the study. In short, through document analysis, the mandatory content in relation to this topic could be simplified in order to achieve the proposed aim of the study.

## Distribution of Literature

Tab. 1 shows the division of the monitored works on the basis of categorization into fundamental and technical analysis. Twenty-three works (23) were based on technical analyses based on historical stock price prices and using charts as the primary tool for predicting stock market developments. Seventeen works (17) were based on fundamental analyses containing macroeconomic, sectoral and industry indicators. Furthermore, a division is made according to the method used to predict the stock market into exclusively artificial intelligence (fuzzy logic, neural networks, ANFIS), other methods and combining prediction techniques.

Tab. 1 – Distribution of the literature based on categorization. Source: own research

Category	No. of papers	%
<b>Fundamental analysis</b>	<b>17</b>	<b>42.5</b>
AI	9	53
Others	2	12
Combinations	6	35
<b>Technical analysis</b>	<b>23</b>	<b>57.5</b>
AI	9	39
Others	5	22
Combinations	9	39
<b>Total</b>	<b>40</b>	<b>100</b>

## 4 RESULTS

### Fundamental analysis

The study shows that 42.5% of the works studied were based on fundamental analysis, as shown in Tab. 1., 53% of all works based on fundamental analysis applied fundamental indicators through artificial intelligence tools. Another 12% of the works used a technique other than artificial intelligence and the remaining 35% of the works used a combination of AI methods with tools such as linear programming or a support vector machine. In terms of length of time frame, Dichtl study (2019) with a length of 38 years clearly dominates. The periodicity of the data is at least monthly and higher not daily. An overview of the most frequently used indicators of fundamental analysis, based on the performed literature search, is given in Tab. 2-4, while only researched articles that use exclusively fundamental analysis are listed.

These fundamental indicators are widely used to predict equity instruments or measure stock market performance. Specifically, Şerife (2014) examined the importance of several financial indicators on stock prices by considering many sectors. He found that P/B has the most

significant impact across all selected sectors. Pradhan and Paudel (2017) found that ROE, EPS and dividends per share are positively related to stock prices. Arkan (2016) studied the importance of financial indicators in three different sectors: industry, services and investment. He concluded that the return on assets and ROE are significant and have a positive impact on stock prices. Lam (2002) examined the impact of beta, company size, leverage, P/B and EPS. The study revealed that the beta has no effect on stock prices, while all other variables do. Saeidi and Okhli (2012) evaluated the effect of the ROA ratio on the Tehran Stock Exchange. Their research showed that ROA has a strong positive impact on stock prices.

The results of this study revealed that the most used fundamental indicator is P/E. In addition, it has been observed that a very high percentage of studies that use P/E in models are likely to use other similar indicators such as EPS, P/B.

Tab. 2 – Overview of fundamental indicators using AI. Source: own research

Sources	Methods	Data	Period	Fundamental indicators
Zhang & Qi (2005)	NN	China	2015-2017	P/E, P/B
Othman & Schneider (2010)	FL	-	-	EPS, P/E
Mahajan, Jamsandekar & Kulkain (2015)	ANFIS	BSE India	2013-2015	ROCE, EPS, PE, liquidity ratio, ROI
Lam (2004)	NN	S&P	1985-1995	16 variables in the financial statement and 11 macroeconomic variables
Khan, Alin & Hussain (2011)	NN	ACI	2010	NAV, P/E, EPS, GI, volume
Enke, Grauer & Mehdiyev (2011)	T2FLS	S&P 500	1980-2009	price index, M1, production index IP and PPI etc.
Boyacioglu & Avci (2010)	ANFIS	ISE National 100	1990-2008	return, DJI, DAX, BOVESPA index, gold, USD, IP, interest rate, risk-free interest rate, etc.
Li, Xiao & Guo (2019)	LSTM	China's Growth Enterprise Market	2009-2019	P/E
Janková & Dostál (2019)	FL	ETF of NYSE	2017	risk, return, Sharpe ratio, tracking error

Tab. 3 – Overview of technical indicators using other methods. Source: own research

Sources	Methods	Data	Period	Fundamental indicators
Dutta, Bandopadhyay & Sengupta (2012)	LR	NIFTY index	2005-2008	EPS, P/B, P/E
Dichtl (2019)	LR	Gold	1976-2014	11 financial indicators (inflation, USD, DY, etc.)

Tab. 4 – Overview of technical indicators combining different methods. Source: own research

Sources	Methods	Data	Period	Fundamental indicators
Sasan, Azadeh & Ortobelli (2017)	GA, MLP	TSE	2002-2012	44 financial indicators (P/E, P/S, EPS, etc.)
Thawornwong & Enke (2004)	NN, LR	S&P	1977-1999	31 financial and economic variables
Makki & Abdallah (2019)	AI	Apple, Google etc.	2004-2015	price, P/B, P/M
Sheta, Ahmed & Faris (2015)	SVM, NN, LR	S&P 500	2009-2014	27 financial and economic indicators
Gao (2020)	KNN, k-Means, ANN	stocks	-	P/E ratio, dividend rate, fixed asset turnover rate, gross profit margin and other indicators
Abe & Nakayama (2018)	SVR, RF, DNN	stocks of MSCI Japan Index	1990-2016	25 financial indicators (P/E, EPS, P/B, ROA, ROE, etc.)

## Technical analysis

The results showed that 57.5% of the total number of studies analysed were based on technical analysis indicators, which served as inputs to predictive stock market models, as shown in Tab. 1., 39% of all works based on technical analysis applied technical indicators by means artificial intelligence. Another 22% of works apply a method other than AI. And the remaining 39% used combining methods with AI such as principal components methods, support vector machine or

buy-and hold method. The longest tested framework was provided by studies by Chourmouziadis and Chatzoglou (2016), who used 16 years for stock market analysis. The results in Tab. 5-7 also show that the most commonly used technical indicator is the simple SMA moving average. However, in all monitored studies there is a combination of several technical indicators. SMA is most often combined with EMA, RSI, MACD indicators.

An overview of the most frequently used technical indicators, based on an extensive literature search, is given in Tab. 5-7, including the artificial intelligence technique used to predict financial instruments and other more detailed information.

Tab. 5 – Overview of technical indicators using AI. Source: own research

Sources	Methods	Data	Period	Technical indicators
Gunasekaran & Ramaswami (2014)	ANFIS	BSE SENSEX	2009-2010	price, volume, EMA, MACD, MFI, RSI, Arms Index
Chourmouziadis & Chatzoglou (2016)	FL	Athens Stock Exchange	1996-2012	parabolic SAR, GANN-HiLo, MA, MACD
Esfahanipour & Aghamiri (2010)	ANFIS	Taiwan Stock Exchange	2003-2005	volume, MA, BIAS, RSI, K, D, MACD, PSY
Gao & Chai (2018)	NN	NYSE	2000-2016	ACD, MACD, CHO, RSI, MOME, AC, PROC, VROC, OBV, EMA, MA, etc.
Vargas et al. (2018)	NN	S&P 500, DJIA	2006-2013	EMA, MACD, RSI, OBV, BB, momentum, Williams %R, A/D, etc.
Naik & Mohan (2019)	ANN	NSE	2008-2018	33 technical indicators such as SMA, EMA, momentum, MACD, RSI, etc.
Nair, Mohandas & Sakthivel (2010)	ANFIS	BSE SENSEX, FTSE 100, NASDAQ, NIKKEI 225.	2000-2010	RSI, volume, SMA, MACD, open, close, highest and lowest price
Chandar (2017)	ANFIS	Apple	2005-2015	MA, Williams %R, Disparity
Omar et al. (2018)	ANN	Brazil and Chile	2003-2018	WMA, SMA, momentum, Stochastic K%, Stochastic D%, RSI, MACD, CCI, Williams R%, A/D

Tab. 6 – Overview of technical indicators using other methods. Source: own research

Sources	Methods	Data	Period	Technical indicators
Tanaka-Yamawaki & Tokuoka (2007)	PC	NYSE	1993	momentum, MA, SLMA, RSI, MACD, MAD, RCI, PL, SLEMA
Almeida, Lorena & De Oliveira (2010)	buy-and-hold	Brazil	1998-2009	SMA, RSI, volume, SCP
Luo, Wu & Yan (2010)	SVM	SSE	2007-2008	SMA, MV, MVR, EMA, Disparity
Ratto et al. (2018)	ML	20 stocks of NASDAQ	2017-2018	MA, EMA, MACD, RSI, BB, SO, TR, AVR, Williams R%, CR
Kamble (2017)	Random Forest	stocks of NSE, BSE	-	MACD, RSI, KDJ, BB

Tab. 7 – Overview of technical indicators combining different methods. Source: own research

Sources	Methods	Data	Period	Technical indicators
Patil et al. (2020)	ARIMA, GCN	30 stocks of NYSE	2017-2019	22 technical indicators
Nti, Adekoya & Weyori (2020)	MLP, SVM	GSE, JSE, NYSE, BSE-SENSEX	2012-2018	SMA, EMA, MACD, RSI, OBV
Ding & Qin (2020)	LSTM, DRNN	Shanghai composite index, stocks of PetroChina and ZTE	-	open, close, low, high prices, volumes, money, change
Wen, Lin & Nie (2020)	PCA, LSTM, CNN, MLP	Pingan Bank	2016-2018	close, open, high and low price, turnover, trading volume
Wang (2020)	SVM, Random Forest	S&P 500	2004-2018	11 technical indicators (Williams R%, CCI, CMO, MACD, etc.)
Vijh et al. (2020)	ANN, Random Forest	stocks	2009-2019	open, high, low, close prices, volumes, MA
Chen et al. (2019)	ARIMA, BPNN	Bitcoin	2017	MA, close and high prices
Khare et al. (2017)	LSTM, MLP	10 stocks of NYSE	-	EWMA, MAD, MACD, RSI, RCI, momentum
Chen & Hao (2018)	SVM, ANN	China	2008-2014	SMA, EMA, MACD, volume, RSI, OBV, MTM

## **Data Collection and Data Sources for Future Research**

This concept paper is based only on a review of the related literature on artificial intelligence and its application in financial markets. Future research will be a quantitative study in which data on investment instruments will be collected through the AMADEUS portal or publicly available sources on Yahoo Finance. Based on the obtained data, indicators based on this work will be calculated. Tools such as cluster analysis, correlation matrices, etc. will be used for the selection of indicators.

## **5 DISCUSSION AND CONCLUSION**

### **Theoretical relevance**

Extensive literature research conducted in this work was initiated to identify and assess indicators from fundamental and technical analysis in order to predict stock market developments primarily through artificial intelligence based on related academic studies from all possible sources of stock market predictive research. The result was therefore the identification and assessment of forty (40) works of the relevant stock market prediction literature. However, I do not claim that this review is exhaustive, as this article does not provide a detailed practical understanding of the state of predictive model research. Based on a review of many scientific domestic and foreign articles and contributions, a summary of indicators from stock analyses was created, which serve as inputs to models of not only artificial intelligence. This document will therefore complement the literature on these variables and provide a summary of the appropriate indicators and indicators to increase and improve the performance of the models.

### **Stock market relevance**

This study discusses all important fundamental and technical indicators of widely used prediction methods in financial markets. The most common and used technical indicators for stock market prediction were again SMA, EMA, MACD and RSI. On the other hand, the most common input indicators entering the models were identified, namely P/E, EPS, P/B. Primarily, technical indicators are used more often than traditional fundamental indicators. In addition, there has recently been a combination of several prediction techniques combining artificial intelligence, especially the artificial neural network LSTM with the support vector machine and traditional linear regression techniques.

### **Limitation and recommendation for future research**

This conceptual work has analytical limitations because it relied on data previously collected by other scientists. The second limitation was that all literature on the topics was not sufficiently researched due to time constraints. Based on the reviewed literature, it is recommended to conduct further research to verify whether these selected or identified variables actually have a significant impact on the prediction of stock market developments.

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# MONETARY TRANSMISSION MECHANISM OF CZECH NATIONAL BANK DURING INFLATION TARGETING

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## **Abstract**

Since the end of 1997, the Czech National Bank has switched to a new monetary policy regime, which is referred to as inflation targeting. The Czech Republic is one of the first transforming economies to take this step. During the period of inflation targeting, the central bank managed to significantly reduce the average inflation rate in the domestic economy. However, it is still necessary to analyse how monetary policy is passed on to the domestic economy. This knowledge is key to the conduct of monetary policy but is also useful for commercial banks and other estimates. The transmission of monetary policy is an essential element for central banks. This work follows this assumption. The aim is therefore to assess the impact of monetary policy implementation on the domestic economy. The results show that the CNB fundamentally influences output in the Czech Republic and can therefore contribute to the stabilization of the economy in a situation of unfavourable development. The central bank's transmission mechanism is then assessed using the structural vector autoregression (SVAR) model. These models show that an increase in the short-term nominal interest rate leads to a decline in output over 13 months. The overall peak is then in 19 months with an impact of -0.39%. Restrictive monetary policy therefore has an impact on output over a monetary policy horizon of 12 to 18 months. Monetary policy does not fundamentally destabilize the nominal exchange rate of CZK / EUR. In addition, the price level is developing steadily. However, the results at the price level are not entirely convincing and are often a weak point of the VAR analysis for monetary policy.

**Keywords:** *Czech National Bank, transmission mechanism, monetary policy, SVAR, impulse response functions*

## **1 INTRODUCTION**

Knowledge of monetary policy transmission is essential for the creation of optimal monetary policy by central banks. This is also the reason why several monetary economists are focusing on this issue. For the analysis of the environment of the Czech Republic, the problem was mainly the lack of data, because the new inflation targeting regime began to be used at the end of 1997. This work then builds on existing research and extends it to a longer time horizon. A significant benefit of the work is the discovery of time delays in the monetary policy of the Czech National Bank. The aim is therefore to assess the impact of monetary policy implementation on the domestic economy. It is then an analysis of basic macroeconomic variables. The work provides background information for further analysis and research. The work is inspired by the research of the authors Arnoštová and Hurník (2005) from the Czech National Bank.

Since the 1980s, VAR models have been used to assess monetary policy. These were unlimited models that were based on research by Sims (1980). However, the approach was too econometric, and monetary economists needed to introduce economic theory into the models. Therefore, modifications of these original models are rather used today. A similar approach will be used in this work as well. The analysis is based on the creation of structural vector autoregressive models (SVAR). The reason is the effort to bring research closer to economic theory and to avoid the problem with price puzzles. The application of short-term restrictions

is based on the work of Arnoštová and Hurník (2005). But the basic research is the work of Kim (2001). The results show that the CNB's monetary restriction has a major impact on the output of the economy. The central bank is therefore able to stabilize the development of the domestic economy if its policy is implemented optimally. The price level and the nominal CZK / EUR exchange rate are not fundamentally affected.

The conclusion of the work Arnoštová and Hurník (2005) is the fact that in 2005 they were not able to perform a completely comprehensive analysis. The reason was primarily a lack of data. This work then builds on the acquired knowledge and further develops it. However, the analysis is rather additional and basic. The benefit is primarily in the possibility of using the results in further research and evaluation. The analysis encounters a problem with the price puzzle, which is then solved by introducing restrictive assumptions and the development of commodity prices. It should be noted that the price level for these models is often a problem.

However, the results at the price level are not entirely negative for the central bank. They do not show that the CNB is not able to influence the development of the price level through monetary policy. But rather, the price level is stabilized. The final goal of monetary policy is achieved. That is, the stability of the price level. The central bank responds to shocks with conflicting policies and thus stabilizes developments. Thus, the development of the output of the economy in the horizon of monetary policy is only affected. However, it is not possible to judge whether the resulting effect was stabilizing or not.

The work therefore builds on previous research but complements it with a longer period. The analysed period is 2000M01 to 2020M12. The aim is to obtain the largest possible amount of data due to the construction of the VAR model. These models are very sensitive to the total number of observations. In addition, it is a period of advanced inflation targeting in the Czech Republic. Structural changes in the economy are then controlled over a longer period using a shift dummy variable. It is not appropriate to completely divide the VAR model into several periods due to the reduction of the number of observed variables.

The outline of the paper is as follows. In section 2, author describes the general theoretical background. Section 3 presents methodology and definition of empirical models. The section also contains a description of the input data. Section 4 illustrates and discuss results of estimations. This section contains models for monetary policy transmission in Czech Republic. Section 5 is the conclusion.

## **2 THEORETICAL BACKGROUND**

### **2.1 Theoretical definition of econometric approach**

To analyse the transmission of the monetary policy of the Czech National Bank, a multidimensional model of economic time series will be applied, which according to Hušek (2007) is used for dynamic analysis of time series of two or more variables. Specifically, this method is referred to as the vector autoregression model.

Hušek (2007) argues that the econometric procedures of VAR structures were developed in the 1980s in response to large-scale macroeconomic models whose theoretical basis was highly uncertain and difficult to verify. Moreover, it is a natural link to the original one-equation autoregressive models.

According to Christiano (2012), the pioneer of the method is Christopher A. Sims, Nobel Prize winner for Macroeconomics. Sims (1980) in his work *Macroeconomics and Reality* suggested using VAR models for the following cases: forecast of economic time series, design and

evaluation of economic models and assessing the consequences of alternative economic policies.

Christiano (2012) further states that designing and evaluating economic models is the most important field of application of VAR structures. Especially because of the possibility of evaluation of impulses and response of various economic shocks, VAR models are also widely used by the New Keynesian economy.

According to Chauvet and Potter (2013), VAR models are one of the central banks' key tools for developing monetary policy analysis or economic forecasting. The advantage is their relative simplicity, flexibility, and ability to adapt when changing input variables.

## **2.2 Theoretical definition of transmission mechanism of monetary policy**

Revenda et al. (2012) argue that the term transmission mechanism of monetary policy can be imagined as a chain of causal relationships that the central bank uses to achieve its ultimate monetary policy goal. Jílek (2013) defines the mechanism as a chain of economic links that allow changes in the operational objective to lead to the desired changes in the final objective, i.e. the price level, GDP, or employment. At the very beginning of the transmission, there is a change in the setting of the operational criterion. This change further affects other parts of the chain that have the operational objective under direct influence (intermediate criterion). The change in the intermediary markets subsequently leads to an effect on the required quantities. Pavlát (2004) argues that the effect of monetary policy is therefore not entirely direct, but only indirectly through other links and processes. Polouček (2006) adds that commercial banks, and their reactions to changes in monetary policy instruments, have a key role to play in the monetary policy transmission mechanism.

Jílek (2013) further states that transmission mechanisms operate in parallel in several ways, which are often referred to as monetary policy channels. Revenda et al. (2012) claim that since World War II, central banks have used several transmission channels and their modifications. Revenda (2011) adds that in practice, central banks may use a combination of multiple transmission mechanisms simultaneously. It is therefore not possible to state unequivocally which transmission mechanism is efficient or most preferred.

Since the end of 1997, the Czech National Bank has been using a very specific transmission mechanism. Specifically, it is inflation targeting. Price stability has become the only monetary target. The central bank switched to regulating the quantified inflation rate using the repo rate. As part of inflation targeting, the central bank can use, for example, an interest rate channel or an exchange rate to achieve the final goal.

According to Jílek (2013), inflation targeting is a monetary policy regime. A characteristic feature is the medium-term view when monetary policy is forward-looking. The required inflation rate is the final goal of monetary policy within this transmission mechanism. Monetary policy achieves the final goal directly through the operational criterion. Thus, not only through an intermediary target, which was common with previous mechanisms. However, according to Polouček (2006), inflation targeting is not entirely without an intermediate target. For example, conditional inflation forecasts can be identified as a mediating target.

## **3 METHODOLOGY**

### **3.1 SVAR Models Approach**

Hušek and Formánek (2014) report that VAR models in some cases require the application of constraints within endogenous variables. The reason may be many parameters or their statistical

insignificance. These restrictions will ensure better economic verification and more significant results in the final presentation of the models. Interpretation of the results can be performed, for example, using the response function. In addition, the economic theory of unlimited VAR models cannot be avoided in the identification of SVARs.

According to Mumtaz and Rummel (2015), the VAR equation (SVAR) without a level constant takes the following form:

$$Ay_t = C(L)y_t + Bu_t \quad (1)$$

where  $u_t$  denotes normally distributed structural shocks, ie  $u_t \sim N(0, \Sigma)$ .  $\Sigma$  is a diagonal matrix. Matrices A and C are matrices of parameters of delayed or non-delayed endogenous variables. For the calculations, EViews7 is based on equation (1), but due to identification problems the coefficients cannot be estimated directly. Above all, it is necessary to adjust the equation to the standard form, which, according to Hušek (2009), does not contain feedback between model variables.

According to Mumtaz and Rummel (2015), the next step is to estimate the standard shape of an unlimited VAR model in the form:

$$y_t = A^{-1}C(L)y_t + A^{-1}Bu_t = H(L)y_t + \varepsilon_t \quad (2)$$

Mumtaz and Rummel (2015) report that matrices A, B and  $C_i$  for  $(i = 1, 2, \dots, p)$  in equation (1) are not individually detectable from the estimated matrices  $H_i$  and the general covariance matrices  $E(\varepsilon_t \varepsilon_t') = \Omega$  for shocks  $\varepsilon_t$  of reduced shape. The only way to recover equation (1) from equation (2) is by applying restrictions to the VAR model. These restrictions may be short-term or long-term.

When applying the short-term constraints Mumtaz and Rummel (2015), it is based on equation (2). First, the random stochastic residue,  $A^{-1}Bu_t$ , is estimated from the residue  $\varepsilon_t$ . Comparing equations (1) and (2) and their residues, the following relationship is found:

$$\varepsilon_t = A^{-1}Bu_t \quad (3)$$

after adjustment:

$$A\varepsilon_t = Bu_t \quad (4)$$

Mumtaz and Rummel (2015) state that the requirement to use restrictions or identification schemes is that the form is given by Equation (4). This form is commonly referred to as the AB model. By introducing zero constraints on parameters A and B, we also pass constraints to the structural shape of the VAR model in the default equation (1).

An example of the identification of an AB model for four endogenous variables obtained by Choleski decomposition of matrices A and B can be expressed according to Mumtaz and Rummel (2015) as:

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{pmatrix}, B = \begin{pmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{pmatrix} \quad (5)$$

According to Mumtaz and Rummel (2015), the total number of restrictions in matrices (5) should correspond to the relation  $(3m^2 - m)/2$ . A structural model with a total of four endogenous variables should contain 22 restrictions. Such a system is then precisely identified.

### 3.2 Clarification of Model

A VAR model will be created for the analysis of the monetary policy transmission of the Czech National Bank. Within this model, restrictive conditions will be applied. The reason is to ensure compliance with economic theory and the effort to reduce the price puzzle. The resulting model is called the structural VAR model, ie SVAR. The construction of the models is then based on the work of Arnořtova and Hurnık (2005) or Kim (2001). Models will be defined in basic forms as VAR (1). However, the delay may subsequently vary depending on the results of the information criteria. Within the specification, the effort will not disproportionately increase the maximum delay of the model. This is due to the relatively limited analysis period and the small number of observations. In this way, enough degrees of freedom will be ensured. The quantities are sorted according to the usual procedure for these models. The resulting models can be described as monetary model.

For the analysis of the transmission of the monetary policy of the Czech National Bank in the period of inflation targeting, the SVAR model is created, which is based on equations (2) and (3.3). The model contains basic economic variables for the Czech Republic. The SVAR (1) model can be defined as follows:

$$\begin{bmatrix} y_{CZ_t} \\ p_{CZ_t} \\ i_{CZ_t} \\ e_t \end{bmatrix} = \begin{bmatrix} c_{y_{CZ}} \\ c_{p_{CZ}} \\ c_{i_{CZ}} \\ c_e \end{bmatrix} + \mathbf{H}(L) \begin{bmatrix} y_{CZ_{t-1}} \\ p_{CZ_{t-1}} \\ i_{CZ_{t-1}} \\ e_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{y_{CZ,t}} \\ \varepsilon_{p_{CZ,t}} \\ \varepsilon_{i_{CZ,t}} \\ \varepsilon_{e,t} \end{bmatrix} \quad (6)$$

where  $\varepsilon_{\xi t}$  are residuals,  $c_{\xi}$  indicates level constants and  $\mathbf{H}(L)$  is a matrix of coefficients of delayed variables. Short-term restrictions will be applied using the AB model (4). The reason is the application of theoretical knowledge defined according to Kim (2001). Another reason is to avoid the effect, which is referred to as the price puzzle. In the long run, no restrictions are applied. In the long run, the quantities are influenced quite freely. A similar approach was used by Arnořtova and Hurnık (2005). The analysis is then primarily valid for a short period. The exogenous variables in the model (6) are mainly the price of commodities and dummy variables for fundamental economic changes in the Czech Republic.

Short-term restrictions on matrices A and B according to Arnořtova and Hurnık (2005):

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ 0 & 0 & 1 & a_{31} \\ a_{41} & a_{42} & a_{43} & 1 \end{pmatrix} \quad B = \begin{pmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{pmatrix} \quad (7)$$

Restrictions are based on a similar work by Arnořtova and Hurnık (2005), but theoretically this approach is defined by Kim (2001). The total number of restrictions is 23, so the system is well specified according to Mumtaz and Rummel (2015). According to Kim (2001),  $y_{CZ_t}$  and  $p_{CZ_t}$  are exogenous to other model variables. The third equation is the reaction function of CNB's monetary policy. Zero restrictions are applied to the output and price level in this equation. This is mainly due to information delays in these quantities. Data on product and price level are not available within a month. The central bank only has data on current exchange rate developments. Therefore, it can react at time (t) on changes of nominal exchange rate. The last equation is the development of the nominal exchange rate CZK / EUR itself. Here, the assumption is made that the exchange rate flexibly adjusts to all variables in the system. It therefore responds to monetary policy, but also to the development of the economy itself. Specification thus defined can be found in matrices (7).

### 3.3 Data and Variables

The overall sample of data contains primarily basic macroeconomic variables for the Czech Republic. In this case, these are endogenous variables. The analysis also includes a variable for the development of commodity prices, which is an exogenous variable. The analysis therefore focuses primarily on the environment of the domestic economy and the selection of variables also corresponds to this. The variables are selected to match the design of the monetary models.

The total number of monthly observations without time series adjustments is 240. The analyzed period is 2000M01 to 2020M12. Input variables of the models include data on the output of the economy, price level, short-term interest rate, exchange rate and oil spot price. Time series are obtained from the ČNB (2020), Eurostat (2020) and EIA (2020). The variables and their sources are described in the Tab. 1. Basic descriptive statistics are also included. Seasonal adjustment was performed in the EViews7 using the moving average method.

Tab. 1 – Deceptive statistics and sources of input variables, 2000M01 to 2019M12. Source: own research

Variable	Source	Description of the variable	Min	Median	Max	Sdev
<i>p_cz</i>	Eurostat	Harmonized index of consumer prices (HICP) for the Czech Republic, 2015 = 100, seasonally adjusted.	72.758	91.78	109.255	10.353
<i>i_cz</i>	ARAD	PRIBOR 3M, monthly average in %.	0.275	1.958	5.643	1.535
<i>e</i>	ARAD	Nominal exchange rate CZK / EUR, deflated by national price level (described by HICP).	23.436	27.727	49.939	7.204
<i>y_cz</i>	Eurostat	Industrial production index for the Czech Republic, 2015 = 100, seasonally adjusted.	58.500	90.550	115.300	14.920
<i>oil</i>	EIA	Europe Brent spot price FOB (Dollars per Barrel), seasonally adjusted.	20.300	61.191	125.467	29.760
<i>dummyA</i>	-	Shift dummy takes value 0 and 1 (after the collapse of Lehman Brothers).	0	-	1	-
<i>dummyB</i>	-	Dummy takes value 0 and 1 (unilateral exchange rate commitment).	0	-	1	-

**Notes:** CZ abbreviation refer to the two-digit ISO country code

Data are examined monthly for more accurate and conclusive results. This is also an argument for using the industrial production index (IPI), which is published monthly, unlike gross domestic product (GDP). This makes it possible to significantly increase the number of observations and degrees of freedom in the models.

In addition, a zero-one shift dummy is created. The aim is to incorporate into the models a possible structural change after the fall of Lehman Brothers and the subsequent financial crisis. Furthermore, an effort is made to differentiate the implementation of monetary policy in the period of unilateral exchange rate commitment. Therefore, a second dummy variable is created. The last exogenous change is the price of commodities. In this case, the price of Brent crude oil. The reason is the effort to alleviate the problem with price puzzles, which often occurs with VAR models. In addition, the price of oil is a fundamental exogenous determinant of the price level in the Czech Republic. It is therefore a primary exogenous factor. Other commodities can be defined, but they are not so crucial for the Czech Republic. In addition, oil is also monitored by the Czech National Bank. According to Estrella (2014), this is a situation when an unexpected monetary policy restriction leads to an increase in inflation in the IRF.

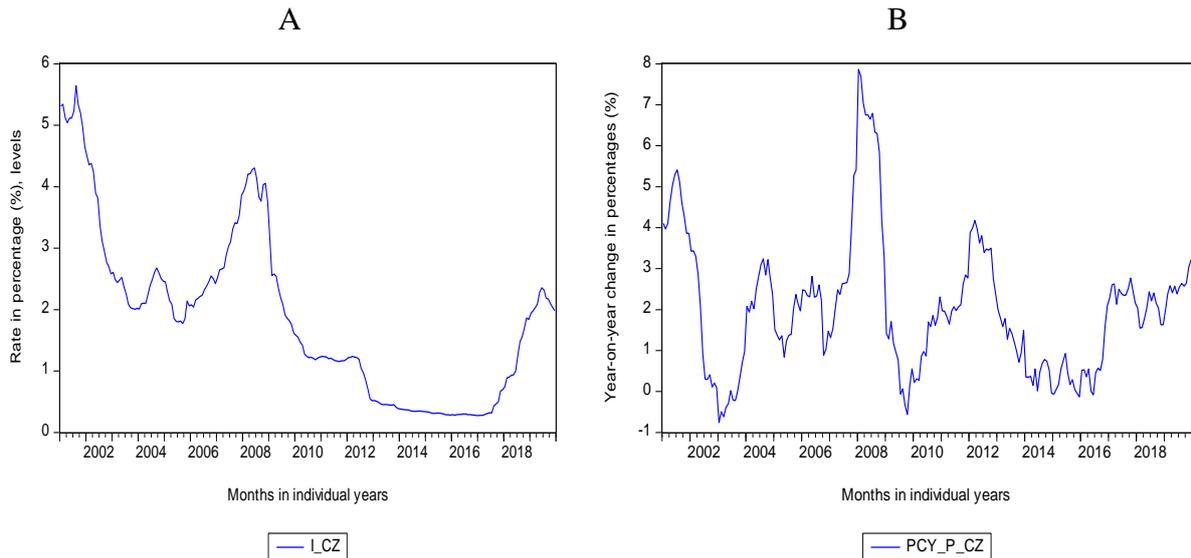


Fig. 1 – Short-term interest rate ( $i_{cz}$ ) and price level ( $p_{cz}$ ) developments in the Czech Republic, 2000M01 to 2019M12, in (%). Source: ČNB (2020) and Eurostat (2020)

The CNB's main interest rate (2T repo rate) is approximated using the nominal short-term interbank PRIBOR interest rate. The reason is the very low volatility of the main rate because central banks often set monetary policy at intervals. The development of the short-term interest rate can be found in Fig. 1, Part A. It is possible to notice the period since 2014, when monetary policy was at a zero-lower bound (ZLB). The Czech National Bank responded by accepting a unilateral exchange rate commitment until 2017. It was an unconventional instrument of monetary policy and there were no changes in the interest rate, which was at its technical zero. The use of expansionary monetary policy was a response to the decline in the dynamics of price level growth (Part B, Fig. 1).

Tab. 2 – Summary results of stationary tests for estimation in levels, month-on-month percentage changes and annual percentage changes. Source: own research

	ADF <sup>a</sup>	KPSS <sup>b</sup>		ADF		KPSS		ADF		KPSS	
	Estimation in levels			Month-on-month percentage changes				Annual percentage changes			
$p_{cz}$	-1.933	0.205	**	-8.264	***	0.130	-2.843	*	0.149		
$i_{cz}$	-1.333	0.172	**	-4.240	***	0.333	-1.637		0.472	**	
$e$	-1.947	0.457	***	-12.077	***	0.249	-2.230	***	0.340		
$y_{cz}$	-1.912	0.153	**	-19.326	***	0.155	-2.272	***	0.113		
$oil$	-2.002	0.359	***	-13.430	***	0.136	-4.076	***	0.221		

<sup>a</sup>  $H_0$  for (ADF): the variable has a unit root.

<sup>b</sup>  $H_0$  for (KPSS): the tested variable is stationary.

**Notes:** the description and characteristics of the variables are given in Tab 1, the  $t$ -statistics for the ADF test and the  $LM$ -statistics for the KPSS test are reported, \* 10%, \*\* 5% and \*\*\* 1% significance level.

An important prerequisite for the application of the VAR model is to ensure the stationarity of time series. However, most macroeconomic time series are not stationary and can be assumed to be the case here. The variables from the Tab. 1 were therefore tested by stationary statistical tests (ADF and KPSS). A summary of the results can be found in the Tab. 2. All statistical tests are performed in the EVIEWS7 econometric program.

After considering the results, all variables entering the model will be in their annual percentage changes. The only exception are short-term nominal interest rates. This is because it is common practice to keep these quantities at their levels. If the VAR model passes the overall stability test, this should not be a problem.

## 4 RESULTS

The following part of the thesis contains an analysis of the transmission of the CNB's monetary policy to the domestic economy. It is based on model (6). The methods used to assess the shocks of ECB are Impulse response functions (IRF). The key period for IRF is the monetary policy horizon (12 to 18 months). However, the maximum rated period will be up to 50 months. The reason for such a long period is to verify the overall disappearance of the currency shock. Only statistically significant shocks will be reported. The evaluation will focus on the peaks of the response to the currency shock. All calculations and estimates are performed in the econometric program EViews 7.

The VAR model (6) is designed with the least possible delay. This is due to the relatively short analysis period and the low number of observations. The model is therefore designed with a maximum delay of two periods. In this case, two months. The accuracy of this specification is also verified with SBIC (Schwarz-Bayesian Information Criterion) a HQIC (Hannan-Quinn Information Criterion). AIC (Akaike's Information Criterion) is not used because the delay length asymptotically overstates. The individual information criteria are set out in A.1. Low delay should ensure greater robustness of the results. However, there may be a problem with autocorrelation, but the models are not used for predictions. When analysing response functions, it is primarily essential to ensure the stability of the model.

VAR model passed the stability test using the roots of the autoregressive polynomial. The results are given in annex A.2. Impulse response functions (IRF) of model are also stable. This can be observed by the gradual disappearance of monetary shock in Fig. 2. Thus, the short-term nominal interest rate in levels did not have a major impact on the overall stability of the model. All the charts show impulse responses with 95% confidence bands. Method used for construction of confidence bands is analytic (asymptotic).

### **The CNB 's monetary policy transmission mechanism**

Fig. 2 shows the response of basic macroeconomic variables in the Czech Republic to changes in interest rates. These variables are primarily the output of the economy, the price level and the exchange rate. This is therefore the reaction of the economy to the currency shock caused by the Czech National Bank. This spill over of the currency shock through the economy is then referred to as the transmission mechanism. This defined mechanism can be internal or external. This article will analyse the internal transmission mechanism of the Czech National Bank. Shocked variable 3-month PRIBOR ( $i_{cz}$ ). However, this approximates the main interest rate of the Czech National Bank (2T repo rate).

The results of the analysis show that monetary policy restrictions primarily affect the development of the output of the domestic economy. The rise in the short-term nominal interest rate will be reflected in a decline in output in just 13 months, with a peak in 19 months and an overall effect of -0.39%. The credit channel of monetary policy transmission is primarily reflected here. In the economy, interest rates on loans provided by commercial banks to clients are gradually rising. Loans are becoming more expensive for companies, but also for consumers. Demand for mortgages is declining. There is a decline in consumption, investment, and construction. The economy is cooling, and the restriction is effective in this sense. The overall impact is then in the monetary policy horizon of 12 to 18 months. The results of the analysis are clearly shown in Fig. 2.

Arnořtová and Hurník (2005) state that a statistically significant decrease in output occurs already in the first months and the total effect disappears in 4 months with a total effect of -0.001%. However, due to the limited sample of data, the result is not entirely conclusive. However, the output is affected by the monetary restriction of the Czech National Bank. To

compare the results with other countries, Kucharčuková et al. (2016) state that euro area output responds to monetary restraint, peaking at 11 months. However, Peersman (2004) concludes that the overall effect in the euro area peaks in 4 months. The results of the research for the Czech Republic are in accordance with common practice and the output reacts relatively similarly to other works. Franta et al. (2011) then state that until the global economic crisis, the sensitivity of output in the Czech Republic to monetary policy increased. In the following period, this transmission develops steadily.

The key finding in Fig. 2 is that the interest rate channel plays a major role in the transmission of monetary policy. The reason is the relatively stable development of the nominal CZK / EUR exchange rate. The author of the work expected a relatively flexible strengthening here. However, this effect did not occur. There is likely to be a rapid overflow of capital and speculative trades. The reason may also be the stable development of the interest rate differential in the entire period under review. Thus, there is no significant increase in the return on Czech assets and comparison with other countries. The exchange rate does not strengthen, and producers do not lose competitiveness. Thus, the output of the economy is not fundamentally affected by the change in net exports. The amount of aggregate loans in the economy then plays a key role in influencing output. According to Arnoštová and Hurník (2005), the CZK / EUR exchange rate strengthened slightly after the first months, but the results are rather statistically insignificant, and the exchange rate is also not fundamentally affected by monetary policy.

Relatively unconvincing results are achieved in the reaction of the price level to the development of domestic monetary policy. Efforts to reduce the price puzzle have been only partially successful. After the monetary restriction, there is no statistically significant increase in the price level. The overall response is therefore statistically insignificant. But the price level is rather rising. However, the stable development of the price level or statistically insignificant results are not completely wrong. It must be stated that the central bank is trying to achieve this situation. That is, a stable development of the price level. The central bank responds to the destabilizing shock with the opposite reaction. The results then appear to be statistically insignificant.

The key finding is that the price level does not respond to the currency shock. Rather, real economic variables are affected. However, inflation should be fundamentally affected in the inflation targeting regime. The central bank is focusing on the development of the price level. However, the results may rather point to the weakness of VAR models. Other works, such as Arnoštová and Hurník (2005), also show that the effect on the price level is not quite well estimated.

The graph of the reaction of the domestic interest rate to the currency shock is placed in the analysis mainly due to the demonstration of the stability of the whole model. We can see that the shock to the custom variable disappears after a few months. The model is therefore stable. This can be demonstrated in addition by using the roots of the autoregressive polynomial. The results are given in annex A.2.

Response to Structural One S.D. Innovations  $\pm 2$  S.E.

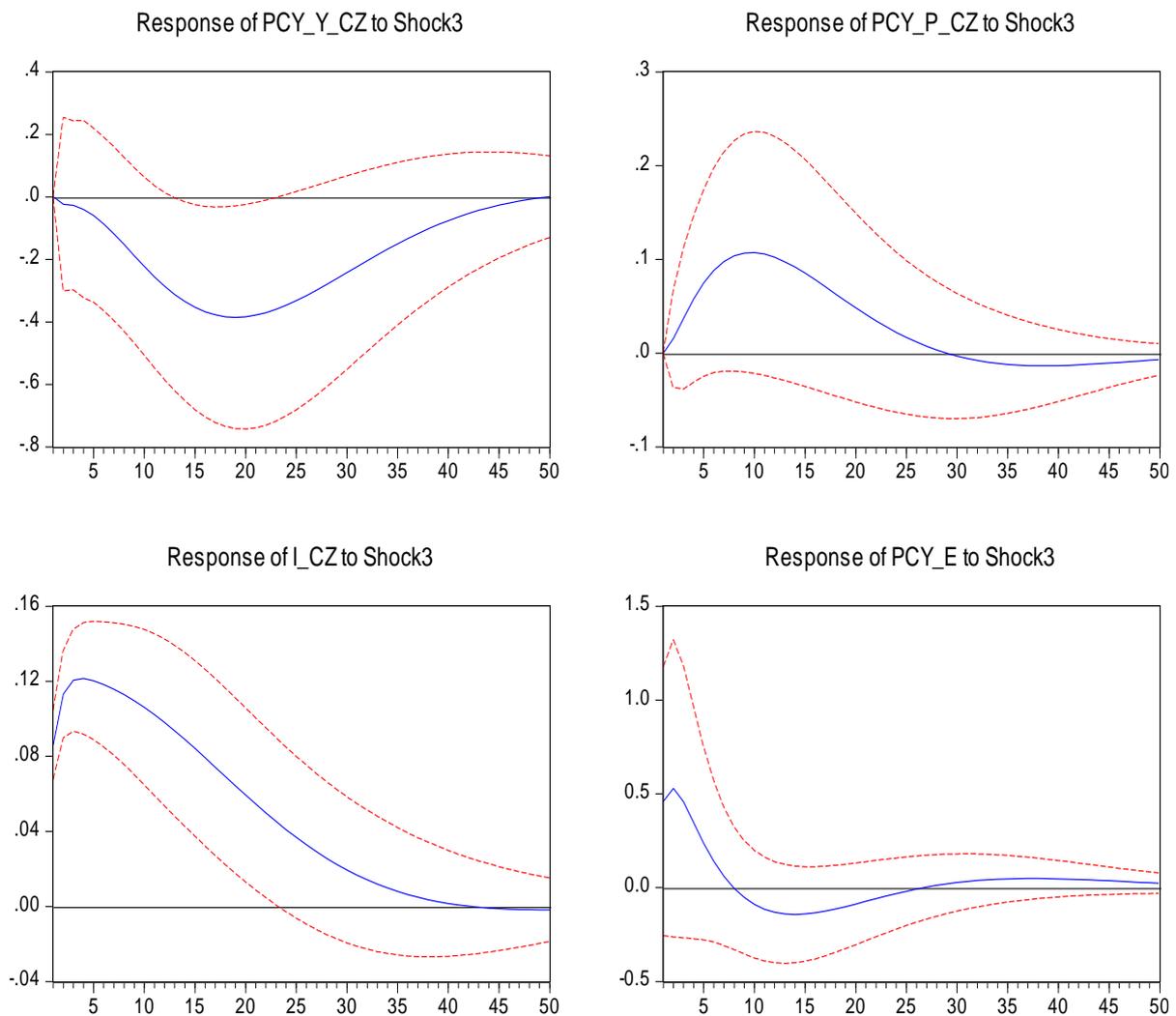


Fig. 2 – Impulse response functions (IRF) for The CNB 's monetary policy transmission mechanism (SVAR model). Source: own research

**Notes:** Shock value is one standard deviation  $\pm 2$  S.E. The variables that respond to shocks are the output of the economy, the price level, short-term nominal interest rate and exchange rate. The SVAR model is defined in (6). Shock is to the system is defined as 3-month PRIBOR ( $i_{cz}$ ). Blue line are responses and red dots are 95% confidence bands. The horizontal axis indicates the individual months, the vertical axis indicates the year-on-year percentage change and interest rates are in levels.

In conclusion, it can be said that the output of the domestic economy is quite sensitive to the implementation of monetary policy. Restriction has a major impact on output decline and the economy is reacting relatively flexibly. The most important is the credit channel and the growth of interest rates in the economy, which dampen economic activity. The channel through foreign trade and the decline in competitiveness is not crucial. Alternatively, the results did not demonstrate this conclusion.

## 5 CONCLUSION

The CNB's monetary policy transmission mechanism is analysed using structural vector autoregressive model (SVAR). The development of monetary policy is primarily assessed using changes in the nominal short-term interbank interest rate, which serves as a proximal variable to the CNB's main interest rate. The aim of the work was to evaluate the impact of monetary policy on the domestic economy in the period of inflation targeting.

The results show that the output of the economy responds relatively flexibly to monetary restraint. A statistically significant decrease occurs after only 13 months, peaking at 19 months. This delay is in line with the monetary policy horizon. The primary reason for this development is the monetary policy credit channel. The impact despite the growth of the nominal CZK / EUR exchange rate and net exports was not confirmed. Domestic exporters do not lose competitiveness because the exchange rate is not fundamentally affected. The price level is also not fundamentally affected by monetary policy. However, this result is in line with the final goal of monetary policy.

The work primarily thwarts the environment of the Czech Republic, but it also compares the impact of monetary policy restrictions with the euro area. The main contribution of the thesis is to broaden the discussion on the effectiveness of the CNB's monetary policy. In particular, the ability to influence the development of the domestic economy in the period of inflation targeting. Previous work had a relatively small sample of data and was therefore not entirely conclusive. However, the work encounters the limitations of VAR analysis, especially in the context of price puzzle. These models lack the expectation factor, which is crucial for the price level. The price puzzle effect in the research was mitigated primarily by the introduction of other exogenous variables and the application of short-term restrictions.

Knowledge of monetary policy transmission is key for the central bank. It is an essential component for creating an optimal monetary policy and predicting the impact on the domestic economy. However, other entities can also benefit from the results, as this knowledge will give them a comparative advantage over competitors in the market. Economic entities can then better adapt and respond to economic change.

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## Appendix

A1: VAR lag order selection criteria. Source: own research

Sample: 2001M01 2019M12

Included observations: 220

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1852.713	NA	280.5665	16.98830	17.23511	17.08797
1	-808.9732	2011.572	0.024571	7.645211	8.138830*	7.844547
2	-770.2162	73.28593	0.019986	7.438329	8.178757	7.737334*
3	-751.0659	35.51523	0.019433	7.409690	8.396927	7.808362
4	-741.6505	17.11879	0.020652	7.469550	8.703597	7.967891
5	-729.9407	20.86477	0.021505	7.508552	8.989408	8.106561
6	-704.8313	43.82735	0.019837	7.425739	9.153404	8.123416
7	-694.5243	17.61554	0.020948	7.477494	9.451968	8.274839
8	-669.5206	41.82449*	0.019371*	7.395641*	9.616925	8.292654

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

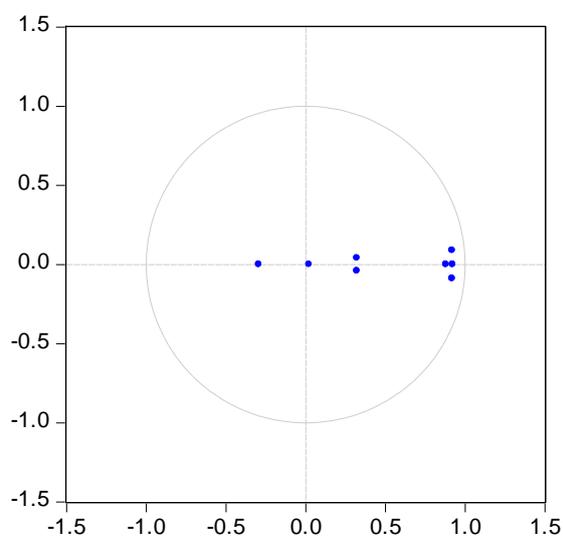
AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

A2: AR root tables for model (6), stability tests. Source: own research

Inverse Roots of AR Characteristic Polynomial



Root	Modulus
0.918402 - 0.088148i	0.922623
0.918402 + 0.088148i	0.922623
0.922066	0.922066
0.880562	0.880562
0.322503 - 0.040476i	0.325033
0.322503 + 0.040476i	0.325033
-0.292709	0.292709
0.021534	0.021534

No root lies outside the unit circle.  
VAR satisfies the stability condition.

# COMPETITIVENESS OF MANUFACTURING SECTOR IN OECD COUNTRIES

*Simona Krivosudská, Dušan Steinhäuser*

## **Abstract**

In the past several decades, the term of competitiveness has become a key criterion in assessing the success of countries, industries or companies. The aim of the paper is to identify the impact of selected factors on own's compiled indicator of productivity in the manufacturing sector in the OECD countries by using regression analysis and verify the assumptions of M. Porter (1990) and P. Krugman (1994) that productivity is synonymous with competitiveness. Theoretical, statistical and econometric methods were applied. To fulfil the aim, the hypotheses were tested by regression and correlation analysis with using the data from the OECD and WBG database. The authors' finding of the paper is existing independence between the variables (productivity in manufacturing and the WEF GCI) that with the increase of the productivity, the value of the GCI will also increase. The authors rejected the hypothesis about interdependence between the variables (productivity in manufacturing and an openness). The economic openness indicator cannot be considered as a measure of competitiveness because competitiveness is not connected with participation in the international division of labour.

*Keywords: competitiveness, manufacturing, productivity, regression analysis*

## **1 INTRODUCTION**

In current conditions of mutual interdependence, there is an increasing challenge in continual need for competitiveness escalation, for individual companies as well as economies. The constant application of innovation to production, transport and communications has transformed the world economy into a constantly changing, highly integrated and competitive place. In such an integrated and highly competed world economy, the key is to increase its productivity and its competitiveness (OECD, 2008).

According to C. Giffi, manufacturing competitiveness, increasingly propelled by advanced technologies, is converging the digital and physical worlds, within and beyond the factory to both customers and suppliers, creating a highly responsive, innovative, and competitive global manufacturing landscape (Industry Week, 2015). In the long run, the prediction and on-time reaction to market needs as well as application of emerging technologies and innovations into the production process are needed for its maintenance. In the globalised and highly competitive world economy, one of the most important key factor for achieving a success is specially the application of technologies and innovations that will strengthen the company's position in the global economy or create a globally competitive leader in the world economy. By implementing production technologies, the costs will be reduced, the quality and quantity of produced goods will be increased. With the aim to achieve lower product prices, most companies move to the areas with lower labour and material costs, or they are looking for the optimal combination of both with the pursuit of sustainable long-term growth.

The World Economic Forum (WEF) has published the global competitiveness report since 2005. The WEF define competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the level of prosperity that can be reached by an economy. The productivity level also determines the rates of return obtained by investments in an economy, which in turn are the fundamental

drivers of its growth rates. The Global competitiveness Index has become a one of the widely recognized assessments of global competitiveness and it is used as an important tool by policymakers of many countries over the years (WEF, 2014).

The presented paper is focused on the competitiveness of OECD countries with the intention of the manufacturing sector. We will compare the accepted Global Competitiveness Index created by the WEF with our own competitiveness indicator. The paper will be devoted to the idea of whether only a country participating in international trade largely is competitive. We will also verify the relationship between the economic openness and our index of competitiveness.

The paper is divided into several sections, the theoretical background section is focused on the explanations of the competitiveness and its definitions. There are summarized the relevant domestic and foreign authors dealing with competitiveness issue. In the methodology section is the aim of the paper and the two hypothesis described. There we can find the database sources, used programs, types of analysis, descriptions of variables and descriptive statistics. In results section are correlation and regression analysis described. Scatter plot shows trends between variables for 35 OECD countries. The discussion section contains the critical comparison with more previous findings of other authors. In conclusion is summarized the aim of the paper, examined dependencies between variables and the results of the authors' analysis.

## **2 THEORETICAL BACKGROUND**

There are various theoretical explanations of the term competitiveness occurred in the literature. The competitiveness has become a major factor for the country's economic, political or social development in the current rapidly developing world. According to the OECD, the competitiveness is the ability of a country to produce goods and services, under the free and equal market conditions, that pass the test of the international market and at the same time ensure the long-term growth of living standards (OECD, 2019).

Account on this, a majority of domestic and foreign authors are dealing with the competitiveness issue. The domestic authors conducted the studies of competitiveness from three areas. The first area consists of an examination of competitiveness within the sectors (Hlušková, 2019a) that has focused on the competitiveness of automotive industry of V4 countries. It concluded that the lack of skilled and relatively cheap labour is becoming a major problem in maintaining of competitiveness of these countries. From the firms' point of view, there were the surveys of the competitiveness problems (Palušková, 2018; Zorkóciová, Škodová, & Petříková, 2017). Palušková (2018) was dealing with the problems of sustainable development application that can help the companies to achieve the competitive advantage within the world markets in a long term. Zorkóciová, Škodová, & Petříková (2017) have examined the excellence models, namely Baldrige model and EFQM model, in the firms' competitiveness strengthening in international markets as the key factors effecting the competitiveness growth. The third area focused by authors was the sight of particular countries (Čiderová, Kovačević, & Černák, 2019; Hlušková, 2019b). Čiderová, Kovačević, & Černák (2019) have dealt with the survey of competitiveness in the context of brexit based on the global competitiveness index and globalization index KOF. Hlušková (2019b) has compared the strategies in the artificial intelligence in chosen countries and their potential impact on competitiveness. In her paper she figured out that the key to competitiveness will be the continual adaptability to the technological changes, but not the long-term comparative advantages.

Several foreign authors were dealing with the competitiveness issue. In general, the theoretical approaches of the competitiveness could be divided into two groups. The first group includes mainly classic economists who understand the competitiveness as the ability of the country to

achieve the advantage compared to other countries. Classic theory explained the success of countries on the basis of factors such as land – F. Quesnay, labour – A. Smith or natural resources – Bodin (Lisý, Čaplánová, & Vongrej, 2018). Under the effect of increasing competition and need of new technologies implementation in the developed industries and economies, the classic theory was eclipsed by the second group of economists, that consists of M. Porter and P. Krugman and the others. Just their assumptions about the competitiveness were the inspiration for the creation of this paper.

M. Porter drew the attention to the export-oriented understanding of national competitiveness. According to this understanding, strategies leading to the support of export tend to the reduction of the competitiveness of such an economy. Porter's study dealt with the survey of competitive success in 10 leading countries in the area of trade. The findings of the study were in conflict with previous conventional opinions about the competitiveness. By studying nations with widely varying characteristics and circumstances, this study sought to separate the fundamental forces underlying national competitive advantage from the idiosyncratic ones. The statement of his work was that the only meaningful concept of competitiveness at the national level is productivity. The principal goal of a nation is to produce a high and rising standard of living for its citizens. Sustained productivity growth requires the economy to improve continuously. Increasing productivity in existing industries will be achieved by the product quality increasing, adding required functions, improving technology or production efficiency increasing. (Porter, 1990; Porter, 1998).

P. Krugman highlighted differences in the competition between the companies and between the countries. In accordance with his study, the competitiveness at the level of firms brings the success of one firm, but, on the other side, there is a deficit for the other firm. It is not possible that both reciprocally competitive firms profit, and so he marked this effect as „zero-sum game“. However, according to him, in the case of countries' competition, this condition is not valid. Vice versa, he points to the fact that the success of one country or region can create opportunities for the other ones. (Porter, Ketels, & Delgado, 2008). However, P. Krugman casts doubt on the approaches to the definition of national competitiveness coming out of the active trade balance as the main determinant of competitive ability of the national economy. (Krugman, 1994). The common conjunction of the theories of M. Porter and P. Krugman is the same argumentation that the only determinant of national competitiveness is the standard of living, which comes from the national productivity growth rate. (Porter, 1998; Krugman 1994).

The term competitiveness was described by several authors as a theoretical, multidimensional and relative concept associated with the market mechanism. This term can refer to different levels of aggregation such as supranational, national, regional, local, industrial, sectoral, as well as to the individual companies. (Siudek & Zawajska, 2014). As in domestic literature, the foreign authors also focused their attention on the study of competitiveness in the sectors (Dotsis, 2018; Dombrowski et al., 2016), competitiveness from the companies' point of view (Kovács, 2018; Dresch, Collatto, & Lacerda, 2018) and competitiveness from the countries' point of view (Gelb, 2020; Kordalska & Olczyk, 2014; Wilson, Lindbergh, & Graff, 2014).

Only a narrow selection of authors dealing with the competitiveness. However, many other authors have focused on the term of competitiveness from various other points of view. Albrizio, Koźluk and Zipperer (2016) investigated the impact of changes in environmental policy stringency on industry- and firm- level productivity growth in a panel of OECD countries. More stringent environmental policies imply an additional burden for firms. Hence, firm-level productivity growth may slow down, at least in the short term. At the same time, incentives for innovation, efficiency improvements and within-firm reallocation may lead to

higher productivity, as suggested by the so-called Porter Hypothesis. To test the strong version of the Porter Hypothesis, they extended a neo-Schumpeterian productivity model to allow for effects of environmental policies. They found out that a tightening of environmental policy is associated with a short-term increase in industry-level productivity growth in the most technologically-advanced countries. This effect diminishes with the distance to the global productivity frontier, eventually becoming insignificant. Gasiorek, Smith and Tamberi (2020) examined domestic competitiveness and value chains in their study. They identified the potential importance of both domestic and foreign competitiveness on net output effects in the context of the UK's exit from the EU (for the modelling they ran an illustrative experiment in which was simulated the departure of the UK from the European Union accompanied by a comprehensive UK- EU free trade agreement. They used an extended partial equilibrium model for 148 agricultural, manufacturing, and services sectors in which they allowed for intermediate input cost. Authors found the negative impact on the UK output will depend on changes in both domestic and export competitiveness. The impact on output will be more significant the greater the integration of firms in international supply chains, and the greater the asymmetric impact of leaving the EU on UK firms relative to EU firms. C. Varum, et al. (2020) have explained the resilience and international competitiveness of a micro-region in Portugal, based on three intertwined levels – firm, industrial structure and region. Authors combined quantitative analysis with qualitative data collected through qualitative research methodologies, what allowed some limitations of both methods to be minimised. The findings reveal the dynamics of the industrial base of this region and how its enterprises remained competitive over time, reinventing themselves through innovation and related diversification, conveying knowledge and expertise from incumbent businesses to new ones with higher value added. Proximity between firms played an important role in learning processes, and knowledge creation was promoted by shared knowledge. Falciola, Jansen and Rollo (2020) have filled the gap of existing indices which do not assess the capabilities of business by the multidimensional framework of firm competitiveness. Through factor analysis, they tested the framework using firm-level data from the World Bank Enterprise Surveys on over 100 countries. Regression based sensitivity checks confirmed that the firm level index built in this paper positively correlates with commonly used proxies of firm competitiveness. The framework is applicable to firms of different size and export status.

Although a large number of authors put their brains to this topic, the term competitiveness is often confused with other terms such as productivity, innovation or market share. Competitiveness Policy Council defines it as an ability to sell products on international markets, while incomes in domestic markets increase in a sustainable way. (Competitiveness Policy Council, 1994). From the WEF's point of view, the competitiveness is the ability of the country to achieve a consistently high rate of GDP per capita growth (WEF, 1996). European Commission describes the country's competitiveness as the ability of the economy to provide its population with high and rising standards of living and high rates of employment on a sustainable basis (European Commission, 2001). Ultimately, competitiveness is about stepping up productivity, as this is the only way to achieve sustained growth in per capita income, which in turn raises living standards. (European Commission, 2011).

On the basis of different definitions of the term competitiveness made by the recognized institutions, it is possible to deduce the inconsistency of the authors to this issue. By creating own's competitiveness indicator, the authors identified the influence of selected factors on the composed model of productivity in manufacturing sector and thus verified the assumptions of Porter and Krugman.

### 3 METHODOLOGY

The aim of the paper is to identify the impact of selected factors on own's compiled indicator of productivity in manufacturing sector in OECD countries by using regression analysis and verify the assumptions of M. Porter (1990) and P. Krugman (1994) that productivity is synonymous with competitiveness. For this reason, we formulated the following 2 hypotheses:

*H1: With the increase in the productivity in manufacturing indicator, we expect an increase in the value of the Global Competitiveness Index.*

*H2: The economic openness indicator cannot be considered as a measure of competitiveness because competitiveness is synonymous with productivity and is not directly connected with participation in the international division of labour.*

Mainly secondary sources of information provided by recognized databases of the World Bank Group (WBG, 2020b) and the Organization of Economic Cooperation and Development (OECD, 2020) were used in the paper. The regression analysis procedure was inspired by literature (Lukáčik, Lukáčiková, & Szomolányi, 2011 and Pacáková et al., 2009). The programs as Microsoft Excel and the GRETl were used for data processing. Correlation analysis was created in the software PAST, including verification of the normal distribution of variables. This is how we identified the influence of independent variables on the dependent variable. The list of variables with descriptions is in following Tab. 1 and descriptive statistics in Tab. 2.

Tab. 1 – Description of variables. Source: OECD (2020); WBG (2020b)

Variable	Explanation
Prod_man_2015	Dependent variable – productivity in manufacturing sector (Prod_man_2015) calculated as multiplying value added of manufacturing and one million, divide by labour force; (time series 2015)
BERD_man_USD_2013	Business enterprise R&D expenditure by manufacturing industry (in millions of US dollars, time series 2013)
GDP_pc_constUSD_2013	Gross domestic product per capita (constant in US dollars; time series 2010)
BBC_2014	Businesses with a broadband connection – includes both fixed and mobile in manufacturing sector (expressed in %; time series 2014)
Unemp_2013	Unemployment expressed as % of total labour force (time series 2013); modelled ILO estimate
CRM_2014	Businesses using Customer Relationship Management (CRM) software in manufacturing sector (expressed in %, time series 2014)
ERP_2014	Businesses using Enterprise Resource Planning (ERP) software in manufacturing sector (expressed in %, time series 2014)
Office_soft_cloud_2014	Businesses purchasing cloud computing services: Office in manufacturing sector (time series 2014)
GERD_GS_millUSD_2013	Gross domestic expenditure on R&D by total intramural sector of performance and source of funds (Government sector - GERD_GS in millions of US dollar, time series 2013)
GERD_BES_millUSD_2013	Gross domestic expenditure on R&D by total intramural sector of performance and source of funds (Business enterprise sector – GERD_BES in millions of US dollar, time series 2013)

Several variables were used for the correlation analysis, as in the regression analysis. We omitted Ireland because we subjectively marked it as an extreme observation. By selecting of the data, we used the latest available value-added data from the set of TiVa indicators (OECD, 2020) from 2015. We had to respect the time lags (so-called lags) of independent variables and the availability of the data. In some case, the quality of the database was affected by a different methodology or an interrupted time series. This information can be found in the source databases for some observations. We have respected the published data. The minimum value of our calculated productivity indicator (dependent variable, Prod\_man\_2015) is approximately 3,146 USD in Latvia, the maximum value has Switzerland with approximately

26,000 USD. The average value of the dependent variable was 10,188 USD for N = 35 OECD countries.

Tab. 2 – Descriptive statistics from software PAST. Source: OECD (2020); WBG (2020b)

	N	Min	Max	Mean	St. dev	Skew.	Kurt.
Prod_man_2015	35	3,146.2	26,288.4	10,188.9	5,020.6	0.9	1.6
BERD_man_USD_2013	33	33.7	221,476.0	16,312.0	43,034.0	4.0	17.1
GDP_pc_constUSD_2013	35	9,693.7	103,721.7	37,373.5	22,112.4	1.1	1.4
BBC_2014	28	89.5	100.0	95.9	3.0	-0.6	-0.6
Unemp_2013	35	3.1	27.5	8.9	5.4	2.3	5.8
CRM_2014	23	7.3	50.6	26.6	11.9	0.4	-0.7
ERP_2014	23	10.7	59.8	38.9	15.0	-0.3	-0.8
Office_soft_cloud_2014	22	1.5	20.2	6.9	5.1	1.2	0.9
GERD_GS_millUSD_2013	33	66.9	125,231.0	9,419.1	22,184.4	4.8	24.8
GERD_BES_millUSD_2013	33	60.9	277,975.0	20,381.5	52,547.7	4.2	19.1

In the following Tab. 3 we can see the tests of the normal distribution of variables in the combination with descriptive statistics. Based on findings, we concluded that the most variables do not have a normal distribution. The BERD\_man\_USD\_2013 variable has a standard deviation value of up to 43,000. None of the three normal distribution tests has a value greater than 0.05. The shape of a distribution describes skewness and kurtosis. R. Hanák (2016) recommends working out Spearman's correlation coefficient for variables with non-normal distribution. The software PAST calculates the correlation coefficients according to the availability of observations for specific two pairs of variables.

Tab. 3 – Normal distribution of variables from software PAST. Source: OECD (2020); WBG (2020b)

	Shapiro-Wilk p(normal)	Anderson-Darling p(normal)	Lilliefors p(normal)
Prod_man_2015	<b>0.04</b>	0.27	0.72
BERD_man_millUSD_2013	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
GDP_pc_constUSD_2013	<b>0.00</b>	<b>0.02</b>	0.25
BBC_2014	0.08	0.10	0.12
Unemp_2013	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
CRM_2014	0.63	0.61	0.51
ERP_2014	0.28	0.50	0.49
Office_soft_cloud_2014	<b>0.01</b>	<b>0.01</b>	0.18
GERD_GS_millUSD_2013	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
GERD_BES_millUSD_2013	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

The availability of data affected the specification of the model. Based on the availability of observations, we have decided for three specifications denoted by the letter N. If we have detected a heteroscedasticity robust standard errors with using the White's test, we applied a heteroscedasticity error-corrected model. We also checked the normal distribution of residuals and the RESET test of the regression specification error test. We have also created scatter plot graphs which showed the relationship between the variable Prod\_man\_2015 and the value of the Global Competitiveness Index according to the WEF (WBG, 2020a), and the economy openness in 2013 (Openness). The economy openness indicator was calculated as the sum of four export and import quarters in 2013, and as the share of gross domestic product in USD (Kašáková & Ružeková, 2019; data from OECD, 2020; WBG, 2020b). As we have already stated, the availability and the data purity affected the specification of our model. We consider this as the first limitation of our paper. Next, our dependent variable was adjusted by Labour Force, although the added value was expressed only for the manufacturing sector. If we have used only employment in manufacturing, we would lose two important observations for model 1 and scatter plot graphs (USA and Canada).

## 4 RESULTS

In the first step, we proceeded to compiling a correlation analysis using the Spearman correlation coefficient in Tab. 4. The strongest direct linear relationship was demonstrated between the variables *Prod\_man\_2015* and *ERP\_2014* (0.78) and the weakest relationship between *Prod\_man\_2015* and *BBC\_2014*. The variable *Office\_soft\_cloud\_2014* and *Prod\_man\_2015* reach a correlation coefficient of 0.52, what represents a medium-strong direct linear dependence. The medium-strong direct linear dependences were calculated also for the pairs *Prod\_man\_2015*, *GERD\_GS\_millUSD\_2013* and *GERD\_BES\_millUSD\_2013*.

Tab. 4 – Spearman’s correlation coefficient from software PAST. Source: OECD (2020); WBG (2020b)

	<i>Prod_man_2015</i>
<i>BERD_man_millUSD_2013</i>	0.66
<i>GDP_pc_constUSD_2013</i>	0.74
<i>BBC_2014</i>	0.35
<i>Unemp_2013</i>	-0.50
<i>CRM_2014</i>	0.61
<i>ERP_2014</i>	0.78
<i>Office_soft_cloud_2014</i>	0.52
<i>GERD_GS_millUSD_2013</i>	0.41
<i>GERD_BES_millUSD_2013</i>	0.55

According to the specification in Tab. 5 there are 3 models estimated by the least squares method, the except for model 1. It was estimated as a heteroscedasticity corrected model because of the presence of heteroscedasticity. Model 1 does not include Luxembourg, Switzerland for missing values, and we omitted Ireland. The other two models do not include USA, Canada and the others.

The estimated value of the *BERD\_man\_millUSD\_2013* variable ranges from 0.03 to 0.09. With an increase in research and development expenditure by 1 mill. USD, we expect an increase in the productivity indicator by 0.03 to 0.09 USD. The effect of research and development spending on productivity indicator is smaller than we expected. We have tried to adjust the variable to take into account the economic size of the states concerned. We have calculated the share of research and development expenditure in the manufacturing sector divided by labour force. However, the quality of the estimates significantly deteriorated. No specification was statistically significant. Therefore, we have accepted the estimate of the variable. In conclusion, it is necessary to invest high expenditures on research and development to increase productivity.

Tab. 5 – Regression analysis from software GRETL. Source: OECD (2020), WBG (2020b)

Dependent variable	Model 1	Model 2	Model 3
<i>Prod_man_2015</i>	Het.-corr. (N = 33)	OLS (N = 27)	OLS (N = 22)
const	3,720.96 ***	-28,341.8	-12,172.9
<i>BERD_man_millUSD_2013</i>	0.03 **	0.06 **	0.09 **
<i>GDP_pc_constUSD_2013</i>	0.18 ***	0.09 **	
<i>BBC_2014</i>		374.60 *	211.74
<i>Unemp_2013</i>		-141.31	-319.09 **
<i>CRM_2014</i>			160.14 ***
R-squared	0.55	0.59	0.74
F-stat	18.65	7.88	12.20
White’s test (p-val.)	0.01 (OLS)	0.48	0.63
Normality test (p-val.)	0.48	0.76	0.13
RESET test (p-val.)	-	0.07	0.42

The estimate of the *BBC\_2014* variable was significant for only one model specification, with only 90% probability. For this reason, we have only accepted the direction and strength of

the bond. A low correlation coefficient also supported the result. Curiously, the CRM\_2014 variable has shown a moderately strong positive effect on productivity. With a 1% increase of the share of enterprises using CRM software, we expect an increase in productivity by approximately 160 USD. Regarding the quality of the estimate, the R-squared indicator reached the highest values in model 3. We have added the variable GDP\_pc\_constUSD\_2013 to the specification as a control variable expressing the economic scope of the examined states. The variable was estimated with the expected sign, with an increase in GDP per capita of 1 USD, we expect an increase in productivity by 0.09 to 0.18 USD. For the same reason, we added the variable of unemployment to the model 3. The result meets our expectation, the variable of unemployment had a negative sign.

In the following Fig. 1, observations of variables can be seen for 35 OECD countries (excluding Ireland, which showed extreme values). We used a scatter plot to interpret trends in statistics.

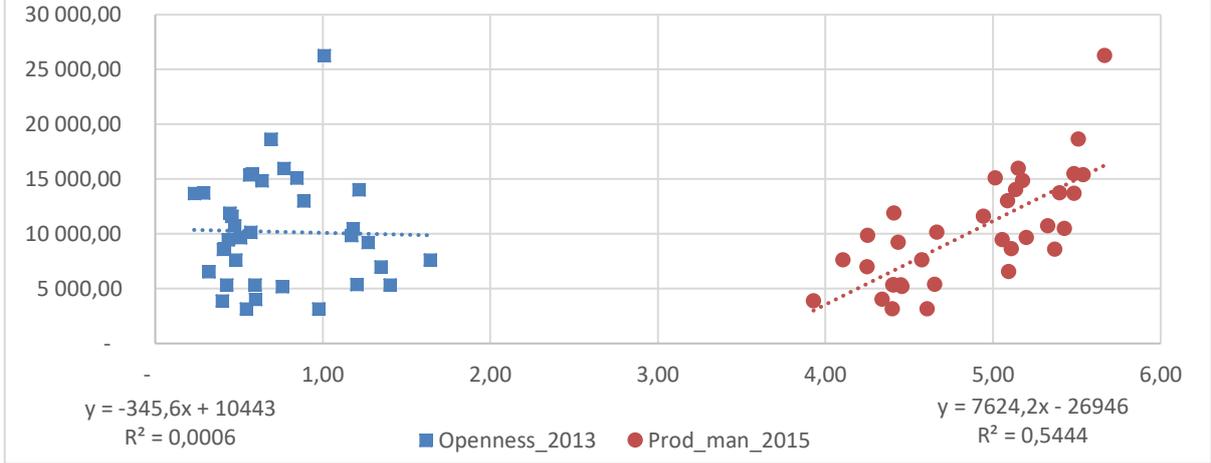


Fig. 1 – Scatter plot between variables for 35 OECD countries from software MS Excel. Source: OECD (2020), WBG (2020a).

The above scatter plot shows a linear relationship between variables. There is a medium-strong positive correlation between the dependent variable Prod\_man\_2015 (Y axis) and the independent variable GCI\_2013\_2014 (X axis, correlation coefficient derived from R-squared 0,54 is approximately 0.73). We can infer from the results that with the growth of productivity in manufacturing, the value of the Global Competitiveness Index also increases. On the scatter plot, we can see an extreme value for the variable Switzerland (CHE), which is considered as statistically non-normal in our observations. On the other hand, we can observe from the scatter plot between Prod\_man\_2015 and openness rate (Openness\_2013), there is no dependence between the variables. We can argue that the variable Openness\_2013 does not affect productivity in manufacturing.

### 5 DISCUSSION

Our study is focused on a group of the most developed countries in the world. Valenzuela-Klagges and Fuenzalida-O’Shee (2020) focused on a different group of countries, choosing Latin American countries, including two OECD members, Mexico and Chile. They examined foreign direct investment, competitiveness (WEF Global Competitiveness Index), trade and productivity: “[...] the greater FDI and global competitive achievement of a Latin American country, the greater its bilateral trade. [...] it is confirmed that commercial opening directly influences the productivity of these countries which, together with FDI, guarantees a sustained increase in productivity.”

In addition to the macroeconomic perspective, competitiveness can be also examined from a microeconomic viewpoint. Faria, Rebelo and Gouveia (2020) examined the impact of export performance on the competitiveness of Portuguese wine companies: “[...] *the results show that firm size, measured as firms’ total turnover, and labour productivity are both positive internal drivers of export performance. [...] the moderating effect of institutional environment is confirmed through the positive and strong effect of the public programmes towards promotion in third countries.*” In this case, we draw attention to the approach of authors who associate export performance with competitiveness. In our opinion, this is possible at the microeconomic level, at the macroeconomic level it is questionable. We have verified the relationship between our competitiveness indicator and the recognized global competitiveness index (Global Competitiveness Index from WEF). We have also confirmed and supplemented the conclusions of Ružeková, Kittová and Steinhauser (2020) that the export performance measure cannot be considered as a universal indicator of competitiveness. Unlike mentioned study, we have worked with an economic openness indicator.

Trang and Nam (2020) dealt with the role of the business environment (Provincial Competitiveness Index), innovation and productivity. The authors used the influence of the productivity share of a specific company on productivity of a leader-company (distance to the frontier) on innovations: “*This study uncovers that the effects of distance to the frontier (measured by the ratio of productivity of an enterprise to that of the industry leader) on innovation are negatively moderated by improved local business environment.*” Innovations in the quantitative model of these authors represented a dummy variable that could signify one of three options: new products, improvement or new production process. We can use the results of this study to expand our approach. If higher spending on research and development increases productivity, they will also improve competitiveness in our understanding. This process can be supported by a healthy business environment. On the other hand, in line with our convictions and values, we reject excessive interference in the economy and recommend that we respect the principles of subsidiarity (e. g. Baroš, 2017).

The next important study is the contribution from Kittová and Steinhauser (2020). Authors divided dataset from statistical reasons into 2 groups of countries and investigated relationship between share of export of the high-technology products on total exports, number of patent applications to the EPO per million inhabitants, intramural research and development expenditure as a percentage of gross domestic product, total research and development personnel and researchers as % of total labour force and total employment and Freedom to Trade Internationally of The Fraser Institute Index of Economic Freedom of the 28 European union’s countries. The authors confirmed with certain limitations the correlation between an increasing of patent applications number, expenditure on research and development and increasing of the high-tech export share on total export.

We consider our study as a continuation of these contributions. We were looking for such a dependent variable, with which we will not be forced to divide the dataset and reduce its statistical significance.

## 6 CONCLUSION

The aim of this paper was to identify the impact of selected factors on own’s compiled indicator of productivity in manufacturing sector in the OECD countries by using regression analysis and verify the assumptions of Porter (1990) and Krugman (1994) that productivity is synonymous with competitiveness. From this reason we have calculated the dependent variable as value added of manufacturing, divide by labour force in the OECD countries. We have computed a regression analysis, which we have used to find factors that determine our competitiveness

indicator. With an increasing of Business Enterprise R&D Expenditure by Manufacturing Industry, we expect a minor increasing of our competitiveness indicator. We consider this as an evidence of the need of science and research investment. However, we recognize that these investments should be substantial.

Next, we have examined the impact of Broadband Internet Connection, Customer Relationship Management Software, in part Enterprise Resource Planning Software, and Businesses Purchasing Cloud Computing Services: Office too. On the one hand, our results did not reveal a strong dependence between the variables. Despite the statistical limitations, we accept the assumption that implementing software solutions increases the productivity of manufacturing and thus, in our opinion, competitiveness.

Finally, we have verified two hypotheses, which we have demonstrated by graphical regression analysis (scatter plots). We have confirmed hypothesis 1 that with an increase the productivity in manufacturing indicator, we expect an increase in the value of the Global Competitiveness Index. We also confirmed hypothesis 2 that the economic openness indicator cannot be considered as a measure of competitiveness because competitiveness is synonymous with productivity and is not directly connected with participation in the international division of labour. With these two hypotheses, we have also accepted the opinion of the authors Porter (1990) and Krugman (1994) that the competitiveness of countries is determined by productivity.

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# VALUE COMMUNICATION IN DYNAMIC BUSINESS MODELS FOR CIRCULAR ECONOMY NETWORK COLLABORATION

*Aleš Krmela*

## **Abstract**

Incumbent B2B companies in natural fibres processing industries join forces in collaborative networks. This aims for enhancing sustainability through inclusion of circular economy (CE) principles into industry-wide applied business models (BM). The networks bring together companies, collaborating in new ways across established supply chains, particularly suppliers and customers but also competitors. The inclusion of the CE principles will lead to an adaptation of the extant BM of the participating companies. The collaboration network for CE affects the value proposition, as well as the logic of value creation, delivery and capture. The benefits of the cooperation in the collaborative networks need to be well understood and shared by the direct and indirect participants. A potential resulting value has to be well communicated both inside the collaborative network as well as towards the stakeholders in the ecosystem. Therefore, a new element of a BM – value communication – is suggested to become an inherent part of the adapted BM. The research question was: How does the value communication affect the BM and support its adaptation towards a CE oriented one in collaborative networks? A qualitative research method has been applied. The author employed mainly a participative observation technique, combined with non-structured, narrative interviews, and expert views. The research is of an applied nature, reflecting a dynamic process of BM adaptation in the subject industry field towards inclusion of CE principles in an industry-wide collaborative network

**Keywords:** *value communication, business model dynamics, business model elements, circular economy, collaborative networks, recycling*

## **1 INTRODUCTION**

Incumbent, B2B companies acting in the field of traditional manufacturing industries are getting more and more under pressure through numerous stakeholders towards making their extant businesses more sustainable and particularly more circular (Abdelkafi & Täuscher, 2016; D'Amato, Veijonaho & Toppinen, 2020). The CE, being considered a strong contributor to an overall sustainability, reached particularly through turning waste into by-product, can lead to positive value proposition, value creation and capture by the focal firm, as well as by the environment (Lee, 2012).

Both the individual companies and the whole industries work towards adoption of their products, processes as well as entire BMs in a way that they better address and include the principles of a CE. It becomes obvious, however, that a single company, no matter how large, can hardly turn the whole industry into a circular principle (Brown, Bocken & Balkenende, 2019).

Accordingly, companies form collaborative alliances (de Man & Luvison, 2019), frequently around industry leaders, aiming to join forces, combining knowledge, towards designing a solution that will be beneficial for individual participants, for the whole industry and for its customers. However, even the combined knowledge of the participating companies might not be sufficient in order to form a powerful, viable circular system.

A third-party involvement might be needed. Being it consultancy companies, external service providers like waste collecting and processing companies. Even start-up companies with an interesting idea or project for turning the waste into by-product (Lee, 2012), product recycling or upcycling. Involvement of the consumer at the point of end use – either individual, private consumers or businesses – is essential, too. A readiness to collect the residual waste, sort it properly, keep it unpolluted and make it ready for collection is important, particularly in the case of uneasy to recycle products.

The collaboration will affect the existing BMs of the participating companies. Not all participants in the alliance will understand the advantage of working in the alliance and the value generated equally. Not all end-users will understand, feel the need and share the reasons for supporting the CE proposed by the alliance.

The understanding and the readiness to collaborate might be negatively impacted by the extra costs linked to the implementation of the CE principles, namely waste collection, while the benefits are possibly less tangible. Maybe because the benefits are hardly directly measurable, maybe because it takes time until they can be monetized. Alternatively, maybe because single participants in the collaborative alliance or end-users might not perceive the CE as their priority.

It is suggested that the value proposition and the value creation resulting out of the collaboration to be well formulated, defined and mainly communicated both to the participants of the collaborative alliance, as well as to the external stakeholders in the ecosystem, namely the end-users at the point of the waste generation. How and why the communication impacts the extant BM was the central question of the research.

## **2 THEORETICAL BACKGROUND**

### **Circular economy**

CE is a concept that can be considered a part of a triple-bottom-line approach to sustainability (people-planet-profit, also known as 3P) as defined by Elkington (1998) on a way towards holistic sustainability. The target of CE is to reduce waste, to separate biological and technical nutrients as well as to use renewable energy (Veleva, Bodkin & Todorova, 2017).

A CE is supposed to meet the 3P requirements, while being a part of an overall sustainability agenda (Brown, Bocken & Balkenende, 2019; D'Amato, Veijonaho & Toppinen, 2020). A CE suggests using the natural resources responsibly, particularly the non-renewable ones, and to reduce waste. UNO has defined 17 Sustainable Development Goals aiming for improving life of the people on the planet in its 2030 Agenda for Sustainable Development (United Nations, 2015). The goal No. 12 – to ensure responsible consumption and production – includes principles of CE, particularly under the target 12.5 – by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. As an indicator of the progress, national recycling rate, as well as amounts of tons of material recycled, are mentioned. Accordingly, societies, governments, municipalities and companies are taking efforts towards implementing the corresponding actions into their operations.

Potting et al. (2016) developed a CE strategy framework 9R, suggesting a hierarchy of possible strategies towards reaching more circularity by the companies. The framework includes 10 various strategies. The lowest in the hierarchy is the R9 or recover, being the recovery of the materials for energy, while the highest one in the hierarchy is the R0 or refuse, being the elimination of the consumption. While it is obvious that at least some of the strategies in the framework might not be practically or reasonably applicable in certain industries or applications, a reduced 4R framework is frequently used. The key strategies in order of priority

are reduce, reuse, recycle and recover. Both Potting et al. (2016) as well as Yang and Evans (2019) admit that recycle is the most frequently applied strategy by the manufacturing companies.

### **Value communication related to sustainability and circular economy**

Tesarova, Krmela and Simberova (2020) study the intensity of communication about sustainability development goals and companies' performance among manufacturing companies. They find that the communication among incumbent, B2B companies is intense, namely the communication related to performance towards sustainable development goal No. 12 – sustainable production and consumption - being by far the most communicated one. The communication regarding sustainability runs on various platforms, while employing non-standardized metrics (Reilly & Hynan, 2014).

Sustainability can well serve as a marketing tool, while the level of communication and its transparency differ (Baldassarre & Campo, 2016). Especially, when it comes to large companies, Lahti, Wincent and Parida (2018) suggest that inclusion of CE principles into the BMs is important for an overall public image of the companies. In other words, the companies are encouraged to communicate about their BM elements value proposition and value creation that have been enhanced with CE principles.

Ki and Shin (2015) see purchasing decisions being positively impacted by the good record of accomplishment on environmental performance, while the communication about the performance is strongly focused on web sites. They see the communication on organization sustainability as “...*voluntary, planned, and strategic communication efforts for working towards a balance of economic, social and environmental goals and values in order to achieve the long-term goals of an organization and its stakeholders.*” (ibid., p. 37). Veleva, Bodkin and Todorova (2017) see communication, particularly in the field of social and environmental performance important, however negatively impacted by the lack of proper metrics.

Brown, Bocken and Balkenende (2019) see awareness and increased literacy as an essential socio-cultural aspect driving the move to more circularity. Both go hand in hand with understanding and communication. Communication of the initial vision for circularity will engage front-runners. Multiple knowledge flows impact the efficiency of the collaborative network.

De Beer (2014) admits that the “*Communication can play a significant role in the value creation process of the organization...*”. Chamberlin and Boks (2018) suggest communication of both tangible and intangible value as important in the sustainability efforts, while they also admit that greenwashing, meaning positive communication but poor actual performance, is present. The recycling can be, in their view, supported by social marketing.

Despite the existence of communication of the value inherent in BMs, specifically in BMs focused on circularity, the conducted research did not identify the value communication being explicitly considered and suggested by the scholars as a fix key element of a BM. The author considers that being a gap in the current explicit knowledge about BMs.

### **Business model and circular economy**

Gassmann, Frankenberger and Sauer (2016) identify seven different schools of thought of BMs. In this article, the BM is looked at through the lens of the recombination school, developed by University of St. Gallen, known as the “magic triangle” (Gassmann, Frankenberger & Csik, 2014). The magic triangle BM depiction targets at answering the underlying questions around the customer and the value inherent in the BM. Particularly: WHO is the customer addressed

by the BM? WHAT is the value proposition of the BM? What is the logic of the value creation (HOW1) and delivery (HOW2)? Finally, how is the value captured, WHY does it generate profits? This view is to a significant extent similar to the Osterwalder and Pigneur's (2010) view, who identified nine elements, so called building blocks, of a BM. The elements are (a) value proposition, representing the element WHAT; (b) key partners, key activities and key resources; here categorized as value creation, representing the element HOW1; (c) customer segments and customer relationships; here categorized as customer, representing the element WHO; (d) distribution channels; here categorized as value delivery, representing the element HOW2; and (e) cost structure and revenue streams; here categorized as value capture, representing the element WHY. All together forming the so-called BM CANVAS. Teece (2010) and Demil and Lecocq (2010) identify similar BM elements, while not necessarily using the same terminology.

Thus, here is a BM understood as a description of the logic of how the focal company or industry does business (Osterwalder & Pigneur, 2010; Teece, 2010), expressed through the key elements WHO, WHAT, HOW1, HOW2 and WHY, each consisting of key sub-elements in line with BM CANVAS. While the value inherent in the BM can be both of a tangible, particularly financially expressed, and of an intangible nature, here the value is understood as a contribution of the particular BM to a satisfaction of a certain need or solution of an existing or a latent problem.

Recent research on BMs aims for linking BM and CE. Particularly, the term circular BM has specifically emerged (Bocken et al., 2019; Frishammar & Parida, 2019; Hofmann, 2019; Levänen, Lyytinen & Gatica, 2018; Lüdeke-Freund, Gold & Bocken, 2018; de Pádua Pieroni, Pigosso & Mcalooone, 2018; Ünal, Urbinati & Chiaroni, 2018). Also, the terms (a) Sustainable BM (Bocken, Boons & Baldassarre, 2019; Lüdeke-Freund et al., 2018; Small-Warner, 2018); (b) BM for sustainability (Presenza, Messeni Petruzzelli & Natalicchio, 2019); (c) BMs for sustainable development (Boons & Laasch, 2019); and (d) BMs around sustainable development goals (Raith & Siebold, 2018) have been introduced and studied by various scholars in a similar context. Tunn et al. (2019) use the specific term BMs for sustainable consumption in the CE.

### **Dynamics of business model and circular economy**

The representation of a BM, however abstract, through the elements WHO, WHAT, HOW1, HOW2 and WHY is a static one. It describes a BM in a given point in time (Cavalcante, Kesting & Ulhoi, 2010). However, for a BM to remain intact over a longer time, the dynamics is important (Gassmann, Frankenberger & Csik, 2014).

The representation of dynamics of BMs' includes the interactions among the single BM's elements (Haggège, Gauthier & Rüling, 2017), their evolution over time, particularly in reaction to changing environment (Cosenz & Noto, 2018). A BM's dynamics can be also represented as creation, extension, revision and termination (Cavalcante, Kesting & Ulhoi, 2010; 2011; Dai, Shen & Zheng, 2011; Ning, Fu & Zheng, 2011), which can be understood as a reflection of the BM's dynamics, thus change, over time.

When including CE into BMs, the value proposition of the BM needs to be seen differently (Veleva, Bodkin & Todorova, 2017). Brown, Bocken and Balkenende (2020) see the BM impacted by a CE towards its innovation, while distinguishing between an incremental and a radical innovation of the BM. While the incremental innovation focuses mainly on the product or the process innovation, the radical innovation would include organizational or market innovation. In both cases, the extant BM shows dynamics towards its adaptation, both in the

scope of activities and in the content of elements, particularly the value proposition and value creation.

### **Collaborative networks and alliances for circular economy**

Brown, Bocken and Balkenende (2019) see CE being embedded in the sustainability field, while being systemic and collaborative in order to create a system impact. A change from linear economy to CE typically goes beyond the boundaries of a single company. It requires collaboration. Companies form alliances in order to apply the CE principles, while scaling-up the needed changes requires a wide collaborative network (Veleva, Bodkin & Todorova, 2017).

Much more, a cooperation of the companies in alliances is critical for success (Brown, Bocken & Balkenende, 2019; 2020), especially when it comes to complex projects (Simoës, Silva & Duarte de Almeida, 2018). A proper configuration of the network through defining the role of each participant is essential. Each partner needs to understand its role in the alliance and the potentially resulting benefits.

Working in alliances positively affects the return on equity, as the experience increases, thus positively affecting the value captured through the innovated BM (Bouncken & Fredrich, 2016). The value capture is negatively impacted by low experience combined with rigidity of the companies, especially of the large and old ones (ibid.). A number of incumbents belong to these.

De Man and Luvison (2019) identify three archetypes of collaborative BMs: sharing, specialization and allocation, with the specialization model being the most frequent one (45% of the cases). It leverages on complementary capabilities, diagonal relationship, and the individual partner's responsibility for costs, revenues, and low level of integration. They admit an unpredictable value creation potential.

## **3 METHODOLOGY**

Based on the findings from the literature and considering the practical problem at hand as described below, our research question was:

*How does the value communication affect the business model and support its adaptation towards a CE oriented one in collaborative networks?*

Yin (2018) considers a case study an appropriate approach when studying a contemporary phenomenon in a live environment. Particularly if the research question is to answer the how or the why, which are considered more explanatory. The case study is the likely method (ibid.) for answering the research question.

A core of the research has been a case study, conducted in the European sector of natural fibres processing industry, characterized by the existence of large manufacturing, incumbent B2B companies. A total set of 15 companies, covering the vast majority of the subject industry output, have been included into the study, the majority of the companies being stock-listed companies, with multi-billion EUR annual turnover, several thousand, or even dozens of thousands of employees.

We have applied a qualitative research method, employing mainly a participative observation technique, combined with non-structured, narrative interviews and expert views declared in panel discussions related to the subject manufacturing industry field. The data have been collected in first half of 2020, to a large extent from written, verbal or visual communications (reports, minutes of meetings, presentations), as well as both individual and group discussions. The groups typically consisted of 5 – 25 participants, being the industry experts from the subject

companies. The data have been recorded and transcribed. The data obtained are of a strongly qualitative nature.

Our research is partially of an applied nature, reflecting an ongoing dynamic process of BM adaptation in the subject industry towards inclusion of CE principles into current, yet largely linear, BM. For confidentiality reasons, the subject industry, products and the names of the participating companies, surveys and events used for collection of the data have been anonymized.

## 4 RESULTS

The subject industry field processes, to the large extent, virgin natural fibres - renewable, recyclable, compostable and biodegradable natural resources, into a product component that, after chemical surface treatment, fulfils a role of a supporting base carrier. The surface treated base carrier is here called LR, and it is suitable for application of another product onto or into the final consumer products. B2C or B2B companies, brand owners, who are in this research considered the end-users of the LR, manufacture the final consumer products.

The findings of our desk and field research based on data from various obtained industry reports indicate that the entire industry in Europe produces and processes approx. one million tons of the LR per year. The virgin natural fibres constitute a significant input as well as a significant cost aspect of the entire LR produced and consumed in Europe. An original value of the virgin natural fibres inherent in the LR depends on the virgin fibre based fibrous raw material commodity market price.

Prior to the intended use, the original natural fibres-based product component, undergoes a surface treatment with a particular chemical in order to become the functional LR and serve for the intended purpose in an industrial use. The treatment in its current technology leads to a more complicated, however with reasonable efforts possible, recyclability of the LR.

Since the LR can be, in its current design and with the currently available technology, used only once for the intended purpose, the LR becomes a pre-consumer waste (Blomsma & Tennant, 2020) immediately after the first use by the brand owners.

Currently, the wasted LR generated is largely either landfilled or incinerated with or without energy recovery, partially also recycled into alternative products. Precise, reliable data about end-of-life of the LR, particularly what percentage of the LR ends up in landfills, is incinerated / recovered for energy, or recycled in other ways, are not available. However, the industry insiders estimate the recycling rate into the same or comparable product - amount of recycled amount vs. amount of originally produced amount - being currently 5-10%.

The fact of high-quality recycling into a product of the same or similar quality and value presumably lacking behind starts to be perceived inside the industry increasingly as a problem that needs to be solved. It is also acknowledged by the industry that the nature of the problem and its possible solutions require an enhanced, targeted communication and education towards the target audience in the supply chain and even wider society and stakeholders.

The industry insiders increasingly believe that the recycling rate of the LR is not favourable for the long-term sustainability of the industry. The awareness became obvious in various expert discussions during numerous industry events like seminars, congresses, trade fairs, meetings, as well as presentations and panel discussions. While 10 years ago this was not really a topic (a statement of the congress participants in winter 2020), in the last two to three years, there is hardly any face to face or group discussion among the participants, without having the

sustainability, and particularly the CE, with focus on recycling, as an important, if not the main, discussion point.

The industry works on solutions towards finding ways how to most efficiently recycle the LR waste. It is believed that improving the industry sustainability through an improved recycling rate better contributes to the sustainable development goal no. 12, while also contributing to an overall improved image of the individual companies and the whole industry.

Working on the solution requires not only innovative technical solutions in terms of product design or process modification by individual companies. The solution desired by the industry in form of introducing a viable collaborative network for circularity through waste collection and recycling will likely impact the extant BM applied in the given industry and the individual companies in a way of its adaptation to a more circular one compared to the current one.

In order to make the recycling successful, a new way of cooperation among the existing incumbents in a form of collaborative networks seems to be inevitable. At the same time, involvement of other stakeholders, mainly waste collecting companies, recycling companies and brand owners, is seen as essential. Especially the brand owners are supposed and need to get involved very strongly. Their proper understanding of the problem at hand, as well as their understanding of the tangible and intangible benefits resulting from their involvement, are essential for their motivation to join and support the waste collection and recycling network.

A sustainability and recycling working group has been established as early as several years ago in the industry, on a platform of an industry encompassing association. However, for numerous reasons – may it be individual companies' interest, lack of awareness, lack of execution power, or perceived complexity of the supply chain, to name at least the most relevant ones – no sufficiently tangible results in form of a clear, industry wide common approach and solutions have been yet reached.

It becomes obvious that neither the industry incumbents nor the brand owners – end-users of the LR are fully aware of the potential monetary value embedded in the unused LR waste. Current collection system generates extra collection costs. The costs are supposed to go further up as the waste treatment related regulations get stricter and as long as the virgin raw material keeps its relatively low current price. One incumbent from the industry said: “The disposal costs are largely dependent on the virgin feedstock prices. When the price goes up, waste collectors are even willing to pay us for the waste. When the prices go down, we have to pay. We do not need to make money with it, we are happy enough if we do not need to pay for the waste disposal.” (face to face discussion, March 5, 2020).

The industry experts believe that approx. 75% of all the LR waste, i.e. approx. 750.000 tons per year, could be specifically collected and recycled / recovered in a high-quality recycling process. Certainly, in the case of fibre recovery from wasted LR through recycling, a degradation of the fibres during recycling as well as costs related to re-establishing of the virgin-like state in a closed loop or extended loop recycling (Blomsma, 2018; Blomsma & Tennant, 2020) would need to be considered. The industry experts estimate that the fibres can be recycled and later reused three to four times.

Such a process has a potential to contribute to the better environmental footprint of the industry. On top, it could generate economic profits through the replacement of part of the valuable virgin fibres with recycled fibres (thus contribute to the WHY element of the industry's BM), while addressing targets declared by the sustainable development goal No. 12, too, and possibly also creating a “green value proposition”, i.e. enhancing the WHAT element of the industry's BM. Through CE, the participants in the industry supply chain may improve their value capture by saving the LR waste collection costs, as well as by replacing at least part of the virgin fibres

with recycled fibres. The industry pays substantial amount for the virgin fibres inherent in each ton of LR and it also pays estimated EUR 120 per ton for LR waste disposal (industry experts' estimate). Both represent costs spent outside the narrower industry supply chain and represent potential partial savings, if the wasted LR is economically collected and processed.

Above are theoretical and illustrative figures. It goes beyond purpose of this paper to suggest an exact and detailed cost – benefits analysis for the given industry, however we believe that a rough indication of the potential gains can help in making the potential benefits initially obvious to the participants and namely to the brand owners.

A survey conducted in spring 2019 among 80 converting companies belonging to the subject industry (Survey, 2019 – anonymized) has shown remarkable results. While 86% of the respondents were aware of the recyclability of the subject product, only 31% of respondents have partially or fully recycled the product. 70% have been never or only rarely confronted with the question about the recycling from their direct customers, being partially large retail goods producing corporations.

An open, free answer text question about the inhibitors for improved recycling indicated, that the main hurdles were (from the most cited to the least): distance, logistics, low volume available for recycling, administrative hurdles, missing engagement of the management, problems related to the reuse and missing consumer awareness. As a minimum, the missing engagement of the management, as well as missing consumer awareness, can be considered as suffering from insufficient value communication.

A real time survey conducted at the beginning of 2020 among the participants of the industry conference has shown that less than 50% of the participants were actively participating in the recycling initiatives, while significantly more than 90% estimated that the recycling rate would go up in the upcoming 12 months. Therefore, a need for CE, particularly in terms of recycling, is seen as an acute one.

The vast majority of industry experts admits, that awareness is continuously missing. Frequently used words in this context are a need for “spreading the message”, “user education” and “industry wide collaboration”. All indicate a need for an improved value communication that would help boosting the related activities towards improving the awareness. Inevitably, a higher awareness, supported by an availability of the viable waste collection scheme, is considered by the experts the key to success in introducing and running the circular collaborative network.

In parallel, it is also obvious that an industry wide collaboration needs strong motivation of all participants. For the time being, frequently top management involvement is not present to the needed extent. By far not all participating companies are represented by the company C-level members in the seminars, conferences or task forces.

At the same time, the individual, face-to-face discussions frequently indicate different attitude and understanding of the topic. That differs from the discussions in bigger groups of participants. An individual understanding of single participant of the urgency of the topic, individual company roles, responsibilities, sharing of the costs and benefits differ largely.

In addition, quite different motivation is obvious. While employees of one large incumbent speak the same “sustainability language”, and while their web page is largely devoted to sustainability and CE, numerous other companies seem to be even lacking a proper understanding of what sustainability and CE is really about. For some companies within the industry the sustainability is on top of their priority list, for the others it seems to be a kind of an “unwanted child we have to take care of, too”.

## 5 DISCUSSION

Based on the results of the research, an extension of the framework of the BM elements WHO, WHAT, HOW1, HOW2 and WHY (Gassmann, Frankenberger & Csik, 2014) with a key element VALUE COMMUNICATION (VCO), is proposed – see figure 1.

While the VCO is seen as interacting mainly with the value proposition (WHAT) and value creation (HOW1), it affects all the other elements and sub-elements of the BM, too. Although VCO is seen as relevant for any kind of BM – no matter what business or industry it is applied in, the author posits that the VCO element is particularly important in BMs for CE collaborative networks (de Beer, 2014).

The VCO element is essential for BMs in all stages of the life cycle of a given BM, while dynamically evolving over the lifetime stages. The VCO is important at the early stage, when dynamically adopting the extant BMs of incumbent B2B companies and traditional industries for establishing and initiating the collaboration networks.

The VCO supports and enhances an understanding among participants of the collaborative network, particularly if the benefits resulting out of the cooperation and the roles of the participating companies are not undoubtedly clear from the very beginning, as it is frequently the case (Brown, Bocken & Balkenende, 2019). Despite hurdles, in the initial phase, the enthusiasm of the participants will be relatively high, as the majority wants to reach the commonly declared targets.

At later stages of the life cycle of the BM, the VCO needs to be dynamically adapted. The experience increases, however, if particularly the desired results are not reached fast enough, some partners in the collaborative networks might suffer from losing interest, commitment, motivation and attention.

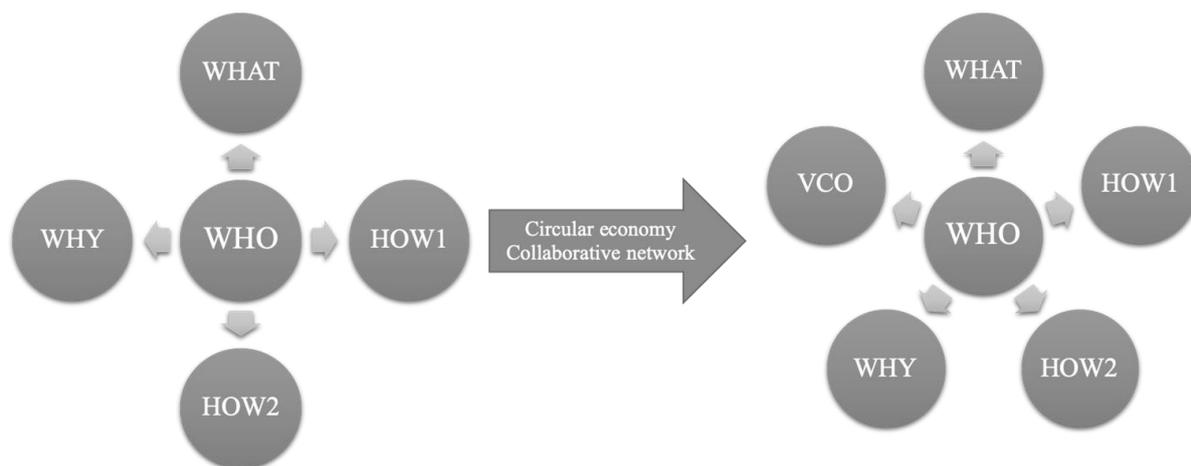


Fig. 1 – Extended BM for CE collaborative network. Source: Gassmann, Frankenberger & Csik (2014)

The VCO is essential for reaching out to the stakeholders in the external ecosystem, particularly the users, in a desired way (Chamberlin & Boks, 2018). First, since it is important support for inclusion of the external stakeholders into the collaborative network. Here, the VCO will support in convincing the stakeholders about their indispensability for the adapted BM for CE to properly function for the good of all involved.

Practically all interviewed respondents have highlighted a need for a proper education of the companies at the point of an industrial use of the subject product. They feel a need to emphasize the real recyclability and thus the reachable circularity of the product. The users need to be made particularly aware of their indispensable role in the process of making the LR available

for collection, in needed purity, without contamination through foreign particles, objects and similar, in a needed volume. At the same time, they need to be made aware of the benefits resulting out of doing it right, both tangible and intangible (Chamberlin & Boks, 2018).

Second, the VCO will support in making it understandable and obvious to the participants in the collaborative network, what their roles and what the potential resulting benefits are. The VCO will support the middle management in presenting the advantages to the C-level (top executives, management board), particularly in case of conflicts of the value proposition of the collaboration network and the existing business. Thus, the C-level will get fully committed and support the collaboration as a strategic overseer (de Mann & Luvison, 2019).

Third, external stakeholders, not directly involved in the process, need to be made aware through VCO of the process itself, about its benefits. They need to be aware of the fact of circularity options existing in the subject industry. VCO will support the single companies, their management and employees, in improving the understanding of the value proposition, value creation, value delivery and value capture reached through the adapted BM.

It became obvious that individual participants of the collaborative network of the companies working in the same business field have quite different goals and expectations. When joining the collaborative network, their individual motivations are different. There are first-movers (van Mossel, van Rijnsoever & Hekkert, 2018) and strong believers in the value of the collaboration for the future of the industry. There are “me too” participants, who start to be more and more convinced, but need some more motivation. And finally, there are also participants, who seem to feel compelled to join just in order not to be seen as outsiders.

Although the common target of “improving the overall sustainability of the industry” seems to be shared by all participants, their individually declared (and eventually also the non-declared) understandings of what needs to be done, how, by whom and when, are somewhat differing to a partially significant extent.

A value proposition of the entire industry field, including improved performance in the area of ecological sustainability, supported by a CE, needs to be properly shaped and accordingly supported by a strong value communication, becoming an inherent, key supporting part of the BM of the individual participants, of the collaborative network, and the whole industry.

## **6 CONCLUSION**

Sustainability, and particularly CE, does not simply happen. The transition from a linear BM to a BM including CE principles is an uneasy to manage process, particularly for incumbent, B2B companies. It can be assumed that through implementation of the CE principles into the extant BM, all its elements will be to a certain extent impacted.

A dynamic transition to circular business, leading to adaptation of its value proposition, value creation, value delivery and value capture elements, needs to be supported by communication about the value inherent in the adapted elements. Thus, it is suggested to incorporate the value communication as a key element into the adapted BM. While value communication is suggested to become an inherent part of any BM, it is essential namely before, during the dynamic transition and afterwards, when fully operationally adapted BMs for CE run in the collaborative networks.

Since the studied collaborative network in the subject industry is yet evolving and the value communication is being designed, the measurable results of the success of the collaborative network are not yet available. Therefore, it also cannot be yet precisely quantified what the contribution of the value communication to the results of the collaboration was. It is seen as an

avenue for further research to measure and quantify an impact of the value communication on the key elements of a BM. Further, the contribution of the value communication to reaching the defined goals of the collaborative network is seen as an opportunity for further research, too.

While the research has been conducted inside one particular industry, the fact that it included 15 different companies, to a certain extent also active in other industries, supports possible generalizability of the results also the other industries.

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# ATTRACTION EFFECT IN MARKETING CONTEXT: LITERATURE REVIEW

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## **Abstract**

The paper serves mainly as a literature review about the topic of attraction effect with the focus to their practical application and relevance in consumer decision making and marketing. The goal of this paper is to summarize and compare the previous research about the attraction effect made in the field of behavioural economics and decision making, putting it in the marketing context. This paper employs the method of bibliometric analysis focused on period from 1982-2020 to track the growing research interest among authors. Taking in account 120 studies indexed in Web of Science, the growing interest in the past years can be noted and major keywords associated with the topic were identified, forming five clusters. Based on the results of the bibliometric analysis the literature review is presented focusing on the marketing context with the goal to pinpoint the direction of the possible future research. It was found out that certain aspects reflecting marketing reality like brands, different types of products or real economic consequences of choices are just recently gaining attention in the studies.

**Keywords:** *asymmetrically dominated alternative, decoy effect, bibliometric analysis, marketing*

## **1 INTRODUCTION**

The behavioural economics and decision making can be not only described as interdisciplinary field which mixes methods, findings and topics common both in psychology and economics but its research and application often outstretches to many other fields and disciplines, for example medicine, biology, finance, management, marketing. One of such topics which can be traced to variety of disciplines the topic is the attraction effect, often known or referred to as effect of asymmetrically dominated alternative or decoy effect as well.

This effect is a particular context effect and it is observed to happen when the choice probability of a baseline alternative increases when an inferior alternative is included into the choice set (Huber et al. 1982). Considering the individuals and groups face various decisions (economic or non-economic) on a daily basis, it is comprehensible the effect is applicable to many situations and therefore, also researched in different contexts such as politics (Herne, 1997), tourism (Gonzalez-Prieto et al., 2013), game theory (Colman et al. 2007), job candidates selections (Highhouse, 1996). The effect has been recently observed not only for human decisions but in certain animal species for example monkeys (Parrish et al. 2015). The more traditional object of interest in the decision making is a consumer. Finding out how consumers behave and think and what fuels customers decisions has been an important task for marketers and firms for decades now. Therefore, it is understandable that traditionally a part of research about asymmetrically dominated alternatives is also focusing on the consumer behaviour.

In this paper, the goal is to analyse and compare the previous research made about the effect of asymmetrically dominated alternative with focus on its connection to consumer behaviour and possible application or replication in marketing field. To meet this goal, literature review and bibliometric analysis is used. It is also a first attempt to analyse the broad topic of the most popular context effect in marketing context and it shall be developed more in the future research work.

This paper is organized as follows. The following chapter describes the brief theoretical and historical background of the attraction effect. Methodology and data collection stands in the third chapter. The fourth chapter contains the results of bibliometric analysis and the review of findings while the conclusion is in the last section.

## 2 THEORETICAL BACKGROUND

The attraction effect is known as an ability of an inferior alternative to increase the attractiveness of another alternative when it is added into the choice set and it has been the subject of research in several scientific fields. It was first demonstrated by Huber et al. (1982). The authors introduced the option of adding an asymmetrically dominated alternative into an originally binary choice sets for 6, mostly tangible, products. They observed that adding such an alternative increases the probability of choosing an item which dominates it.

In their experiment, target product T was superior in one dimension (e.g. quality/taste) and the second competitor product C was superior in another dimension (e.g. price) which meant the participants had to decide which compromise to accept – whether choose lower price for lower quality or higher quality for higher price. However, when a third alternative D was added to the choice set and constructed in a way so it is similar but slightly worse in its characteristics to product T (same quality but higher price) it led to product T appearing more attractive compared both to product D and product C. Location of asymmetrically dominated alternative according to Huber et al. (1982) is shown in Fig. 1.

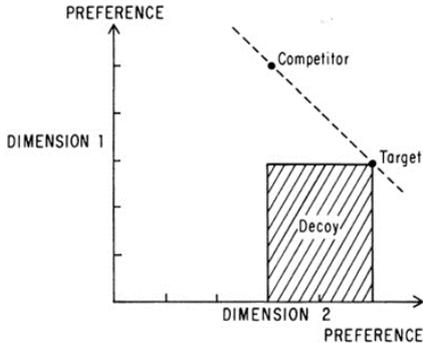


Fig. 1 – Possible placing of decoy alternative. Source: Huber, Payne & Puto (1982)

This newly added option is called asymmetrically dominated alternative because one of the original alternatives is clearly superior to it in its characteristics and therefore dominates the option. Huber et al. (1982) and other authors often uses the term decoy for this alternative as it is not expected that many individuals would choose this option itself and its presence is only supposed to raise the popularity of the target alternative.

The study brought evidence that individuals do not choose product with highest utility or value but the perceived utility and value are rather temporarily influenced by the rest of the alternatives in the choice set. This challenges the standard economic assumption that preferences and utility are set and preference of one product over another should not be depend on whether a third unrelated product is present (Noguchi & Stewart, 2014) but rather implies that they are rather formed during the decision-making process according to the available choice set (Simonson & Nowlis, 2000).

Ever since the decoy effect was discovered, many more experiments have been carried out by other researchers: (1) either exploring the possible explanation and underlying mechanisms of

the phenomenon itself and/or (2) studying various contextual factors which might affect the strength of the attraction effect.

The possible explanation is suggested by Simonson (1989) who says the attraction effect reflects the influence of added alternative on an ability to justify their choice to oneself and others. Wedell (1991) claims that agents employ a decision strategy according to which they look for dominance relationship and if they find one then they choose the dominating alternative. However, most commonly tested explanation of the effect is range-frequency theory. Huber et al. (1982) tested four possible strategies of positioning the decoy to create the asymmetrically dominated effect and they are shown in the fig. 2.

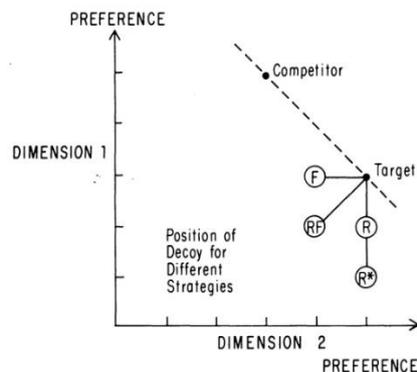


Fig. 2 – Strategies of decoy placement. Source: Huber, Payne & Puto (1982)

It is possible to see that the decoys are inferior to the target alternative only in one dimension in strategies F and R. In the strategy F (frequency), the decoy further highlights the dimension in which the target is clearly superior even towards the competitor while in the strategy R (range), it increases the range of dimension where the target is originally inferior to the competitor. In case of strategy R\* (range \*), the decoy option is strongly inferior to target in one dimension. Strategy RF (range-frequency) is a combination of strategies R and F, meaning the decoy is inferior to target in both dimensions at the same time. Huber et al. (1982) reports R\* and R as the most successful strategies leading to the increase of the target's popularity approximately by 13%. In a meta-analysis done by Heath and Chatterjee (1995) it is supported that larger range extensions lead to greater increases in the target share as well. Same opinion is shared by Soltani et al. (2012) who also find positive correlation between the range and the strength of the attraction effect.

The second branch of research focuses on testing the attraction effect using different types of choice problems. These studies were conducted under a variety of circumstances, such as those with participants that ranged from picnickers to online panellists, as well as more controlled laboratory studies, including ones conducted with functional magnetic resonance imaging equipment (Hedgcock and Rao 2009). Although limits and boundaries are found in the studies, the attraction effect has been generally considered robust over the decades (Doyle et al. (1999). However, recently this claim is being challenged by Frederick et al. (2014) or Yang and Lynn (2014) whose experiments did not bring enough evidence on the effect significance and the authors point out an important question about the practical relevance of experiments previously carried out and their implications for marketing practice. Huber et al. (1982) called for validation of the attraction effect in an actual choice setting and three decades later, Huber et al. (2014) still notes the lack of documentation on attraction effect in today's marketplace.

Therefore, we decided to find out the current scientific interest about the attraction effect in relation to marketing and consumer behaviour. For that purpose, we employ the bibliometric analysis which is introduced in the next chapter.

### 3 METHODOLOGY

The main aim of this paper is to analyse and compare the previous research made about the effect of asymmetrically dominated alternative with focus on its connection to consumer behaviour and possible application or replication in marketing field. The main research question is: how is the current research about attraction effect connected to the field of marketing and reflects marketing reality and marketing findings?

The bibliometric analysis is a scientific and frequently used statistical method for analysing the published studies and it serves for searching the citation relationships and influences on other fields and publications. We used this method to find out the citation networks between the most used keywords in studies examining attraction effect in marketing context.

To employ this method, it is possible to use data from various databases. The selection of the data, based on the availability, was narrowed to the two most important ones for this study – Web of Science Clarivate Analytics, referred to as WoS, and Scopus. Gavel and Iselid (2008) claim that WoS includes 84% journals which are indexed by both databases but only 54% can be found in Scopus. Due to this fact, WoS database was chosen as the source of data. The obtained data was then processed by VOSViewer, a software able to display large bibliometric maps with an interpretation of showed clusters (van Eck and Waltman, 2009).

First step was to collect the data and selection of the sample which was made of studies containing the term ,decoy effect‘ or ,attraction effect‘ or ,asymmetric dominance‘ and ,marketing‘, either in the title of the study, in the abstract or as the keywords. Given the variety of names for the same phenomena it was necessary to use all three of them. Only studies from years 1982 to 2020 were included due to the fact the phenomenon was not discovered earlier.

In total, 120 records were found in all research categories and the results were put into following categories: WoS category, country/region, document type and source title. In the following Tab. 1 there are displayed 10 most frequent subcategories in the given categories.

Tab. 1 – Categories for term ,decoy effect/attraction effect/asymmetric dominance‘ and ,marketing‘. Source: own research based on WoS database (2019)

	WOS CATEGORY	COUNTRY	DOCUMENT TYPE	SOURCE TITLE
1.	Business	USA	Article	Journal Of Marketing Research
2.	Economics	Germany	Proceedings Paper	Journal Of Consumer Research
3.	Management	China	Early Access	Journal Of Business Research
4.	Hospitality Leisure Sport Tourism	England		Marketing Letters
5.	Environmental Studies	Australia		European Journal Of Marketing
6.	Operations Research Management Science	Canada		Journal Of Economic Behavior Organization
7.	Business Finance	Netherlands		Journal Of Marketing
8.	Psychology Applied	South Korea		Marketing Science
9.	Environmental Sciences	Spain		International Journal Of Culture Tourism And Hospitality Research
10.	Geography	Italy		International Journal Of Emerging Markets

The next step was processing the records to VOSviewer. There were chosen criteria to select the final sample – there was selected co-occurrence analysis focusing on all keywords with full counting method which means every occurrence of the term in the document is counted. Next, there were chosen only networks where keywords appeared at least 3 times which resulted in 69 keywords shown in the final map.

The final map shows a variety of colourful and differently sized bubble-like fields which are connected at shorter or longer distance. The colour represents being a part of a certain group –

a cluster. This group mapping identifies topics with highly connected aspects. The size of the bubble fields represents the frequency of the use – the more frequently a keyword is used in the sample the bigger its bubble is. The distances between the keywords represent the connection, the shorter distance means stronger association between the keywords and finally, the connection of terms in the studies is symbolised by the lines.

After the bibliometric analysis with use of the VOSviewer software, the qualitative investigation of the literature was adopted. The document analysis centres on knowledge from scientific documents acquired from databases such as WoS, SCOPUS, ProQuest, and Google Scholar via keywords search as to execute the goal of the present study.

## 4 RESULTS

Based on data received from WoS, there were found only 120 studies involving the attraction effect in marketing context that would be indexed in the database in the span of 38 years (from year 1982 to 2020). That makes it in average about 3 studies published per year. However, it can be actually observed that the scientific interest about this topic is growing in the recent years. While in 80's no studies were found that would connect the newly found phenomenon to marketing field, in 90's and mid 2000's 1-2 studies were published per year. From late 2000's the interest keeps growing reaching the number of over 10 studies published per year from 2010 and on. The most studies per year published are so far in 2019, in total 18 studies. Majority of the studies were published as journal articles 93% and most articles were published in the Journal of Marketing Research. Geographically, majority of articles were published in USA (35%), then Germany and China (each 12%). Authors from other countries take less than 10%. The Figure 1 shows the co-occurrence of the keywords using the full counting method. There are totally 69 items sorted into 5 clusters with 520 links.

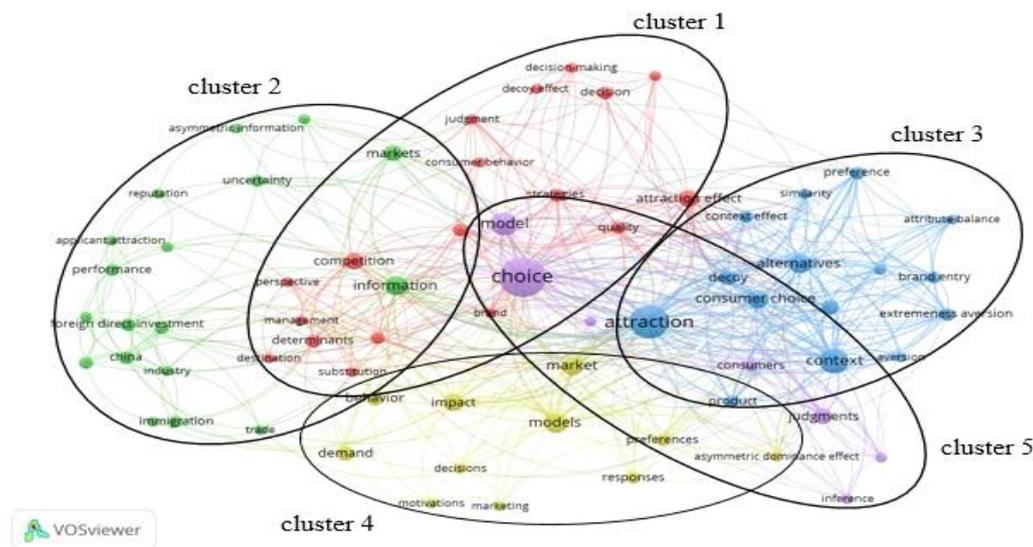


Fig. 3 – The results of bibliometric analysis. Source: VOSviewer (2020)

The core of the first cluster was term ‘attraction effect’ with links to ‘brand’, ‘competition’, ‘product’ and ‘quality’. This cluster also seems to contain the most terms connected to the marketing and management field. The most frequent keyword of the second cluster was ‘information’, then ‘markets’ and ‘foreign direct investments’. Third cluster involves links between words ‘attraction’, ‘context’, ‘alternatives’ and ‘consumer choice’. In this cluster, we can also find connection to other context effects like ‘similarity’ or ‘compromise effect’ and to other aspects of behavioural economics like ‘extremeness aversion’. The fourth cluster is

revolving around 'models', 'market' or 'impact'. And lastly, the fifth cluster is the smallest one but it is involving the most frequently used keyword of all - 'choice', beside that term keywords like 'model' and 'judgement' are the frequent ones for the last cluster.

The highest number of keywords is shown in the cluster 1 and cluster 2, both containing 18 keywords in total which makes them the largest clusters. However, the size of the bubbles in those are not very large and the relationship between the terms are quite distant, especially in the cluster 2. The shortest links and quite sizeable bubbles can be meanwhile observed in the cluster 3 which has quite close links to the cluster 1 but also links to the rest of the clusters. As already mentioned, the most frequent keyword 'choice' can be found in the smallest cluster 5 and it has strong link connection to terms in all other clusters.

Based on the analysis, we came to several conclusions. Firstly, in the top three WoS categories (Business, Economics and Management) was published in total over 60% of the studies focusing on the attraction effect in relation to the marketing. Specifically, 39% of the studies belonging to the first category Business, 21% to the second category Economics and 10% belonging to the third category Management. Secondly, it can be observed that the interest in this topic is growing in the past five years and vast majority of the studies was published as journal articles.

Finally, we can pinpoint the most frequent terms traditionally connected to the topic of attraction effect are 'choice', 'attraction', 'context', 'consumer choice', 'alternatives' and 'models'. Among the typical marketing terms we can find 'brand', 'quality', 'products', 'strategies' and 'competition' are the ones present in the studies. These terms may help define in what way it is possible to apply the findings about the effect in the marketing and its practical relevance to the field.

Based on the bibliometric analysis conducted and described above, in this part, we introduce the literature review of the attraction effect with focus on its practical relevance and application to the marketing field.

Firstly, we focus on what kind of products are typically used in the studies examining the attraction effect because as the bibliometric analysis showed, product is the most relevant category of the marketing mix when it comes to the attraction effect. During the years, the attraction effect and decoys were indeed examined and replicated many times, using different types of choice sets which involved either tangible or intangible products. The table 2 shows the product categories used in some studies examining the attraction effect in the last 20 years.

Analysing the published studies, it can be stated that majority of authors traditionally involve tangible products like cars, microwaves, TVs, apartments or computers into the choice sets (Huber et al. 1982; Ratneshwar et al. 1987; Simonson; 1989; Simonson and Tversky, 1992; Lehmann and Pan, 1994; Ariely and Wallsten, 1995; Dhar and Glazer, 1996). Less studies focused on edible products, including beverages or different types of food, but in recent years it is possible to find even these categories gaining attention of Hayes et al. (2011), Yang and Lynn (2014) or Sellers-Rubio and Nicolau-Gonzalbez (2015). Less often the studies included in their research services instead of tangible products, there stands out Pettibone and Wedell (2000) or Ďurinik (2013) who for example brought evidence that the attraction effect could be used raise the share of consumers choosing the extended warranty instead of state guaranteed one. Interesting view and usage of the attraction effect offers also Gu et al. (2018) who used the attraction offer to raise the number of customers who purchase premium product (paper book) instead of using free option (e-book).

Except product, attraction effect can be found in the context of other categories of the marketing mix as well. For price, the term decoy pricing is sometimes used and Wu and Cosguner (2020)

quantified the profit impact of using the decoys in an online diamond market, resulting in 21% of retailer's profit. Although less common, studies using the decoys for purposes of advertising can be found. For example, Shieh et al. (2019) used field experiment to find out how decoy promotional messages affect consumers' reaction to location-based advertising and in-store purchase intentions and Moran and Meyer (2006) used the effect of adding a dominated brand between set of 2 initial brands in context of comparison ads and raised the perceived value of the dominating brand.

Tab. 2 – Product categories in studies involving attraction effect in last 20 years. Source: own research

<b>Studies</b>	<b>Product categories</b>
Ahn, Kim and Ha (2014)	Motor rafts
Chuang and Yen (2007)	Suitcases, watches, sport shoes
Dhar and Simonson (2003)	Microwave ovens, cassette players, binoculars
Đuriník (2013)	Extended warranty
Gonzalez-Prieto et al. (2013)	Plane tickets
Hamilton, Hong and Chernev (2007)	Sunglasses, MP3 players, phones, sofa
Gu, Kannan and Ma (2018)	E-books/paper books
Hayes, DePasquale and Moser (2011)	Beverages, solid foods
Hedgcock and Rao (2009)	Cars, hotels, apartments, cruises
Lichers et al. (2015)	Headphones, toothbrushes
Lin et al. (2008)	Microwaves, ovens, binoculars
Mao and Oppewal (2012)	Bike helmets, electric grills, sunscreen
Mourali, Böckenholt and Laroche (2007)	Toothpaste, printers, restaurants
Park and Kim (2005)	Restaurants
Pettibone and Wedell (2000)	Computers, microwaves, restaurants, repair services
Pocheptsova et al. (2009)	Apartments, coupons
Sellers-Rubio and Nicolau-Gonzalbez (2015)	Chicken broth
Tentori et al. (2001)	Coupons
Wu and Cosguner (2020)	Diamonds
Yang and Lynn (2014)	Wine, pizza, steaks, beer, salads, cruises, pastry, flights, hotels, vacation, hot drinks, binoculars, restaurants, appetizers, refrigerators (...)
Yoon a Simonson (2008)	Cars, phones, microwaves

The aspect of brands is also a marketing topic which is often connected to the attraction effect as the previous bibliometric analysis has shown. Although the studies often point out the practical implications for product lines extensions and strategies it was typical that the authors did omit the real-life brands into the research for a long time and usually described the items in the choice sets as 'Brand A' or 'Brand B'. This started to change in the last decade when few studies (Sellers-Rubio and Nicolau-Gonzalbez, 2015; Celedon et al. 2013; Kim et al. 2006) pointed out the lack of the brands in the research and included real brands in the products' description in order to make the consumer's decision making similar to the real life setting where consumers are constantly surrounded by various brands. However, the results of the studies are not consistent whether brands themselves inhibit or strengthen the attraction effect. Kim et al. (2006) found out that the decoy effect is eliminated in case the consumers possess significant knowledge about the brands. Celedon et al. (2013) report that Chilean consumers seem to not be affected by the attraction effect if entrant brand is more familiar than the competitor brand. Sellers-Rubio and Nicolau-Gonzalbez (2015) confirm the existence of the effect when brands are included and add that specifically store brand consumers are more influenced by decoy than national brand consumers.

Brand building is an important process and activity for number of companies and great effort and part of the budget might go to managing brand identity and image as companies hope to get closer to their customers by building similar characteristics and values, by building long-term relationships to gain loyal customers. Therefore, it seems it might be important to know whether consumers might be affected more by the brands presence or presence of the attraction

effect or whether there might be synergy between both of them. Therefore, we would point this area out as one deserving more future attention and interest.

The practical marketing relevance is questioned in more aspects than just in the lack of brands presence. Although Doyle et al. (1999) report the effect occurs even in real market situations as they replicated their lab experiment involving fast-moving products like cans of beans in a local grocery store with similarly positive results, there are not many other studies which would observed the phenomenon in real-life settings. Lichters et al. (2015) analysed attraction effect studies from past 30 years and found out that many important factors, which might influence the strength of the decoy effect, did not reflect the marketing reality in the previously published studies. There are several more studies that try to include realistic factors to the research of attraction effect. Dhar and Simonson (2003) tested the strength of the decoys in cases the participants were offered an option to not make any choice just like during real purchases and found out the no choice option strengthens the decoy influence. Another example might be testing the effect when consumers face real economic consequences. Lichters et al. (2015) found attraction effect to be much stronger when decisions are binding compared to hypothetical ones, underlining the effect's usefulness as a marketing tool.

Frederick, Lee and Baskin (2014) found out the attraction effect is significantly strong when the alternatives are described numerically but not so much when it comes to presenting the alternatives based on qualitative information or when pictures or photos are included. Similar result is presented by Yang and Lynn (2014) who report only 2 significant cases of attraction effect out of total 54 cases and they consider their findings not too positive for marketing practitioners who are hoping to use decoys to raise their market shares. However, Frederick, Lee and Baskin (2014) hope this realisation will lead to higher external validity of the future experiments in order to be able to successfully implement the findings into practice.

It can be therefore pointed out that while majority of studies generally confirm robustness of the effect, from the view of marketing context and practice there are still factors (like distinct consumer or product characteristics) which need to be explored in connection to the attraction effect while trying to raise the external validity by bringing the experiment conditions closer to consumer's marketing reality while maintaining the internal validity of the experiments at the same time.

## **5 DISCUSSION AND CONCLUSION**

The phenomenon of attraction effect is present in many different scientific fields. In this paper, the focus was put on the current findings about the effect in marketing as it could be one of the tools how the company could raise the popularity or shares of their products in comparison to their competitors or simply boost the sales of product in one product line under one brand. It is a first attempt to analyse the broad topic of the most popular context effect and it shall be developed more in the future research work.

Based on bibliometric analysis with 120 publications in Web of Science Clarivate Analytics from 1982-2020, it was found out the most common terms connected with the effect and their connections were found out using VOSviewer software which divided the most common keywords in five clusters. It was found out that the topic of attraction effect in marketing context is gaining more attention in the recent years with growing number of articles published in marketing journals in the past 5 years. Partly, it can be given by the fact researchers are recently calling for higher external validity of the conducted experiments which brings the interest of researchers to replicate the experiments with addition of new moderating factors that are present in real purchase situation.

Furthermore, it was found out the most common product categories included in choice sets were belonging to the tangible products, only few studies included services which could be even more suitable for the practical application of the effect since during the purchase process of a service consumer is usually not influenced by a sensory perception, e. g. the design of the tangible products, which most of the studies about the effect do not consider as a factor so far. Although, the attraction effect might be used when enlarging product lines or raising shares of desired products, there are few studies which pointed out using the decoy in the advertising context as well.

In conclusion, it is possible to say that in the marketing context of research about this context effect the current important task is to keep adding realistic factors to the experiments involving attraction effect and detecting which factors might moderate it. Omitting such factors represents a notable limitation in future studies and raise the question of practical implications of attraction effect, and even other known context effects. The possible space for the future research might be continuing examining the role of brands which has been started in recent studies. The role of brand loyalty or brand awareness when it comes to using the attraction effect in relation to new brand entries to the market could be the possible future research interest to find out how the effect can be used in positioning strategies and how it might influence the competition in the market.

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# THE STATE OF DATA USABILITY IN COMPANIES IN INTERACTION WITH THE SOLOMO CONCEPT

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## **Abstract**

Electronic marketing thus produces a large amount of data every day. Business entities abroad are in favour of such data collection and decision-making. On the other hand, there are domestic businesses that are unexplored, and it is not clear whether businesses are inclined to behave on the basis of data. The aim of the research is to clarify the current state of resoluteness through data in the business environment in Slovakia with regard to internal communication through social networks and mobile phones. The theoretical background is defined by analysis, description and comparison. The paper also uses quantitative methods of marketing research conducted through a questionnaire. The conclusions are based on the results with the help of a description of individual variables, and conclusions are drawn through them. Subsequently, bivariate analysis is applied. The added value of the paper lies in clarifying the potential of data use by business entities and subsequently this knowledge can help in the possible preparation of systems, not only in the scientific but also in the practical sphere, which allow collecting, analyzing and evaluating marketing data in the form of visualization. On this basis, it is possible to determine the direction and progress of the industry in a given environment. The result of the work clearly states that business entities in Slovakia are mostly emphasized on data and also make mostly decisions based on them. Several businesses know the metrics for measuring success. Mobile phones are more prevalent among businesses than social media.

**Keywords:** *data in companies, SoLoMo data visualization, big data in companies, SoLoMo in companies*

## **1 INTRODUCTION**

The use of data in management and marketing is very widespread. If we look to the past, we find authors who have dealt with the issue since 1993, especially in terms of intelligent database and visualization tools. (Parsaye & Chignell, 1993) Progress at that time was mainly related to computer technology, which experienced a big boom. In 1998, Deboeck tried to define and develop data mining. (Deboeck, 1998) It is also important to mention leading authors such as Shaw, Subramaniam, Tan, Welgel, who defined data mining in 2001, respectively defined the whole process of data collection, analysis and, last but not least, data visualization. (Shaw et al., 2001) Later that year, Hirji published important insights into the diversity of data options. (Hirji, 2001) Lisboa and Patel brought a lot of knowledge directly from the field of marketing data collection and visualization in 2004. (Lisboa & Patel, 2004) Continuity can be found in 2007, where Kunz dealt with market data structures. (Kunz, 2007) During the boom of electronic devices, Linoff and Berry published their book, summarizing the possibilities of data collection (Linoff & Berry, 2011). (Krum, 2014) The authors Bouquin and Epstein pointed out the study of market data and the importance of learning to understand data through visualization. (Bouquin & Epstein, 2015) In 2016, Shiokawa, Misawa, Date and Kikuchi published their research where they defined visualization techniques in the market in connection with transactions. (Shiokawa et al., 2016) Recently, Zhang and Shu have studied data research and visualization, who have clarified the process and called for further investigation. (Zhang & Shu, 2019) Recent findings by Ha, Han, and Lee cite artificial

intelligence as the driving force behind visualization, data collection, and the like. (Ha et al., 2020) These facts speak of the need to clarify and further deepen the fact. Whether it's data collection, analysis, reading and visual interpretation of data, research is important in every area. In the home environment, the current situation is unclear, so it is important to clarify the current situation. It is then possible to build on these foundations in the future and thus connect the scientific field with practice. The penetration of mobile devices has increased considerably since its invention in 1973. The discoverer Martin Cooper was at the beginning of mobile phones. (Martin Cooper | Biography, Inventions, & Facts, 2020) Mobile phones have gradually been owned by more and more consumers. A long series of changes and updates have taken place, leading to better devices, new features being added and modules being added. (History of Mobile Phones | What Was the First Mobile Phone?, 2020) Looking back on history came an important milestone in 1992 when IBM invented the first smartphone. At the turn of the millennium, the 3G network was introduced, which was especially important in terms of the speed of the Internet connection. At that time, devices and the Internet were generally too expensive for the average user. Over time, however, the components of smartphones have improved and their price has decreased. In 2007 came an innovation in the form of a full touch screen. Steve Jobs introduced the iPhone, which caused a massive change of smartphone and started mass production. (Evolution of the Mobile Phone - from Simple to Smart, 2020) Social media began to appear after the year 2000. The largest social network, Facebook, was founded in 2004. (McFadden, 2020) Secondary sources summarized by Ortiz-Ospina show that 2010 was a turning point, both for the digital world and for social media, when we saw an increase in the number of users on social networks. From 2010 to the present, we have seen only a slight decrease in the time spent with digital media on personal computers. On the other hand, we are seeing a dramatic increase in time spent using mobile devices, mostly on social media and other digital media. (Ortiz-Ospina, 2019) With the help of the mentioned technological development and the formation of social media, the concept of SoLoMo could be created. Predictions of the future spoke of the mass use of mobile devices in the form of smartphones and the societal use of social media. (Shin et al., 2012) John Doer (Kurtovic, 2012) defined the concept by combining Social, Mobile and Local components at a closer presentation to the professional public at the LeWeb 2011 conference. Loïc Le Meur took care of the presentation and clarification of the SoLoMo concept. (Domenget, 2012) As a result, there has been an increase in use not only on a theoretical level but also in practice. The increase in the use of digital media users, the use of mobile phones and location devices was related to the increase in the use of the SoLoMo concept, which has become an integral part of people's daily lives. Today brings a boom in decision-making based on data. The data come from the digital footprint that each user leaves when using digital devices. There are many mobile users. It is therefore important to answer the question of whether it has the potential to communicate through data visualization on mobile devices.

## **2 THEORETICAL BACKGROUND**

Nowadays, it is important to reach a person in a natural environment and communicate content that is in line with his requirements. We can also say that social media and mobile devices are very popular today. (Digital Users Worldwide 2020, n.d.) The SoLoMo concept began to appear more wide in 2011. (Cavero, 2012) It is important to clarify that the SoLoMo marketing concept consists of three components that are synergistic. Social (social media marketing), Local (local marketing) and Mobile (mobile marketing) components (Papakonstantinidis, 2017). The concept got into its current form thanks to a certain development. The constant development of mobile devices, the need for accurate search and the improvement of algorithms have led the concept to the present state. As stated by the professionally oriented dictionary Technopedia, it

is a mobile-centric form of extended locally oriented search through search tools with the support of the social dimension. (*What Is Solomo?*, 2020) In the definitions of the SoLoMo concept, we observe the same basis for clarifying the individual components. Over time, since the definition of the concept, there has been no paradigmatic change in any definition in the comparison. There is only the possibility of enriching the concept with the Co-commerce component (Bohan, 2012), where commercialization takes place. The author Scott defines social as a defined space for people, where they exchange their thoughts, ideas, inspiration together. They also create content and build relationships here. All this is done online with the help of digital devices. (Scott, 2015) On the other hand, there is a definition where we look at a term from the point of view of a dictionary and then talk about sites on the Internet or programs that allow us to communicate and share information using a computer or mobile device. (*Social Media | Meaning in the Cambridge English Dictionary*, 2020) The conclusion of the definitions is consistency in the part of communication and sharing of content through digital technologies. The basic question according to Heinemann, to which the answer is important when creating proposals, is the following for the So component. What social media do our followers prefer, and what do they expect from retailers or popular brands? (Heinemann & Gaiser, 2015) The result will tell us where our target group is and what content we should provide to our followers. They can be our potential customers or consumers. It is therefore important to answer the question correctly. Nevertheless, we should address the issue constantly, because followers can change their attitudes, perceptions, demands and requirements. Creators are constantly updating social media, so users are constantly facing new features and improvements. If a company opts for the SoLoMo concept, it will have to face the same re-evaluation of the solution as social media platforms change. Social media is mainly used on mobile devices, which puts the concept of SoLoMo in a very positive light and justifies the importance of its use. The local component of the concept is only useful from the companies' point of view if the companies enter the local level of the market. It is clear from electronic marketing that certain technical means are needed to locate the customer. Mobile devices in the form of smartphones provide high positioning accuracy. Social media and web browsers have defined an atmosphere where it is possible to connect users and businesses. The consequence of such a link is the immediate satisfaction of the needs of users within the local environment, where search results are modified by location. In doing so, it is important to meet the condition and be online, transparent and present from the point of view of business entities. Technological modules that are used for localization via a mobile phone are: IP address, GPS, Beacon, Bluetooth and radio frequency identifiers. (Križo et al., 2018) The author Heinemann also defines the issue that we must address when defining the local part of the concept. The question directly asks about the possibilities of providing the location of our customers, whether for our local stores or services. (Heinemann & Gaiser, 2015) In the end, the question is asked mainly from the point of view of society, which can be limiting for creators and research. Moving the question to the consumer and it becomes centric for the question; it will help us to better manage his requirements and needs. There is a security issue with the local folder, but there is a relatively high possibility, despite location collection with the explicit permission of the user not to archive the location. The mobile folder includes mobile devices. At present, mobile devices are also connected to mobile devices, which is currently extremely frequent. It is important for marketing professionals not only to follow trends in this area, but also to consider a strategy for reaching potential customers and consumers. Again, there is clear evidence of the functionality and potential of the SoLoMo concept. The content component also includes the software solution itself in the form of mobile applications. Kaufman and Horton define the division of mobile applications into native applications, mobile web applications, and hybrid mobile applications. (Kaufman & Horton, 2015) The question we ask ourselves for the mobile component is taken again from a company perspective. What can mobile marketing and m-commerce opportunities provide us with, and how can we lift fans and

consumers using mobile devices? (Heinemann & Gaiser, 2015) The question is broad-based as mobile marketing and m-commerce are very extensive. As far as fans are concerned, we can use a question to examine their wishes, needs and possibilities that they use when using mobile devices. Nowadays, it is important to reach a person in a natural environment and communicate content that is in accordance with his requirements. We can also say that social media and mobile devices are very popular today. (Digital Users Worldwide 2020, 2020) This statement contains the essence of the SoLoMo concept. We use the social folder in the form of content that is displayed to users. Thanks to localization devices, we can find them in places where they have a specific need or requirement. The component is closed by the fact that users spend the most time on mobile devices and are available to them to a greater extent almost always and everywhere. Another fact confirming the potential of the future of the SoLoMo concept is the fact about the next generation, also called the IWWIWWIWI generation. Formed an abbreviation of the sentence I Want What I Want When I Want It. According to Gannes, the mentioned generation is significantly connected via social media and is strongly digitally oriented. (Gannes, 2014) This generation is characterized by the use of multi-screens. For this reason, it is important for companies to use the SoLoMo concept and be able to compete in the future. The SoLoMo concept is confirmed by current statistics on the use of mobile phones. According to O'Dea, there are 3.5 billion worldwide, an increase of 300 million users. (O'Dea, 2020) The forecast for the next period is also at least 300 million users. The argument, therefore, remains that the concept of SoLoMo will not weaken in the coming period, on the contrary, it will be increasingly developed among consumers. In the domestic environment in Slovakia, a survey was logically conducted through the GfK agency, and between 2011 and 2017, the frequency of mobile phone use ranged in age from 15 to 79, with a huge increase. That is why it is clear that it is important for marketers to think about this platform as well and they should definitely not neglect it. At the same time, this penetration of mobile phones is across all generations. What is just as important is the time spent on mobile devices with the Internet. According to Clement's statistics, it is 143 minutes worldwide this year. Compared to last year, it is 11 minutes a day and next year it is expected to increase by 12 minutes. Ultimately, even if the time spent on mobile devices stabilizes, we will spend several years of life on mobile devices. Again, this is a confirmation of the importance of using mobile devices in marketing. As far as social networks are concerned, they are currently used by 3.21 billion users, an increase of 0.13 billion users compared to last year. The forecast for next year is 3.23 billion users, which is an increase of 0.11 billion. The result is completed by the fact that 78.5% of Internet users are users of social networks. (von Abrams, 2019) From the point of view of the researched issues, it is important to mention similar surveys. IPass found that 3,700 employees from 1,100 companies who are mobile and therefore do not have a precise place of work say that up to 94% have a phone and work on it for up to 240 hours a year. (Ipass Mobile Workforce Report Finds the End of Downtime as Smartphone and Tablet Usage Rise, 2011) The argument was that they must be connected 24 hours a day, 7 days a week, and that it definitely helps them in productivity. This statement definitely helps to solve the identified problem in the final comparison. Currently, a large amount of data is collected on websites, as well as on social media. On websites, data collection is already an integral part of creating a new website. The deployment of measurement and the measurement and reporting itself has become a matter of course in agencies, but also in business entities. Anyone who does not deploy metering on their website should definitely change that. Common data that is collected includes audience data. Who they are, where and from what facility visitors come? As well as user behaviour in terms of page time, conversion, and bounce rates. Technically, website performance, load time, impressions, and keywords. (What Are the Different Types of Web Analytics and Their Uses?, 2019) Today, it is essential that websites outsourcers also think about data collection and subsequent website updates. Because only a regularly updated site can lead to sales success or

high traffic. Data collection on social media is also called social data mining. (hacker noon, 2020) Social media can often be a source of vital information. Taking a stance on posts and commenting often leads to discussion and opinions, from which a large amount of data stems. By tracking and analysing, we can define what content our followers like, what is most discussed, and vice versa, what content we should omit next time. If we make a comparison with the competition, it will provide us with data to decide on the content and thus reduce the cost of creation or. focus on the contributions that our followers require in a given segment. Marketing campaign data is also generated by collectivization, evaluation and visualization. (6 Step Guide to Creating a Data-Driven Marketing Campaign, 2018) So we can build our decisions about future campaigns from our previous campaigns. The data that can be extracted and analysed are a large in amount, specifically, according to Henegtee on social, it is possible to do keyword extraction, sentiment analysis, market and trend analysis and predictive analysis. (Hengtee, 2020) All types of analysis are important, the easiest is the analysis of keywords or sentiment. There are many approaches and options to achieve a successful analysis. The possibilities of data collection in business entities are a large number, as defined by, for example, Krum can be budgets, business, profitability data, process data, company strategies and research. (Krum, 2014) These data are often analysed in larger and global businesses. Every employee, customer, supplier produce a large amount of data in both online and offline environments. Very often there is a problem with poor quality data and bad analysis, which is often avertable. (*Poor-Quality Data Imposes Costs and Risks on Businesses, Says New Forbes Insights Report*, 2017) There should be a constant awareness-raising and creation of new tools in this area, which would prevent complications and bad decisions. Electronic marketing is currently largely automated. Both in B2C marketing and in B2B, automation is used, in which data is created. We divide data into structured (transactions, customer data, CRM, orders, products) and unstructured (IOT, social media, website visitor behaviour). (Jabbar et al., 2019) This is a direction where the use of data is very current and there are many collection options available. By automation, we can improve sales and reduce costs. In the future, new tools could be introduced immediately. Subsequently, ingenious prediction of behaviour and satisfaction of needs is possible. At present, data is used quite often in large companies in the last 8 years, the use of data has increased twice every two years. Data production worldwide is enormously high - every single user generates a large amount of data. The potential of data in businesses is exacerbated by the fact that two thirds of the companies that analysed the data and decided to use them saw a reduction in operating costs. (Lynkova, 2019) It is important to note that comprehensive data analysis pays off especially for large companies, because the cost of analysing a huge amount of data is very high. However, it is definitely worthwhile for smaller businesses to invest in general functional tools or, where appropriate, in a data analysis and processing agency. Nevertheless, investment in solving data tasks was increased last year. As many as 91.6% of companies worldwide have confirmed this investment. (Lynkova, 2019) Companies adapt to the market environment based on data. The decision helps them to predict future consumer behaviour. Based on the analysis of data, 53% of business entities made decisions in 2017. (Columbus, 2017) Compared to 2015, this is an increase of up to 17%. The survey was conducted in the USA, mainly on telecommunications and banking businesses. The potential for data use was far from being contained. If a business wants to keep up with modern trends, it is important to follow the data. Collection and analysis are essential for proper analysis. We are currently seeing an increase in data connectivity and automation in the form of artificial intelligence. (How Big Data and AI Work Together, 2019) The electronization of marketing leads to more extensive data, also called big data. Correct interpretation is important to make them easier to understand, and since one can best read the visual elements, (Koponen & Hildén, 2019) it is an ideal way to decipher the evaluation and interpretation of the results by the company's management. To do this, we need to know what is the best form of visualization.

Based on the correct distribution of information from this data, the company's management can then make a better decision on the future direction of the company. According to Börner and colleagues, it is important to use the correct graphical representation for various variables. (Börner et al., 2019) There are various graphical elements that encode the data into a more comprehensible message. These are, for example, a bar graph, a pie chart or a word cloud. On the other hand, experts believe that it is important to use not only the correct display, but also the analysis through the right software for the correct display. (P'ng et al., 2019) The knowledge gained shows that it is important to maintain the process of correctly defining data collection, data storage, data analysis, as well as data visualization by selecting appropriate software and graphics. Wang and Lu defined data visualization as the representation of internal related units in the form of data, information, and knowledge using computer graphics processing, image processing, and signal processing. (Wang & Lu, 2019) With the right displaying, we can bring users a correct understanding of quantitative data. The data displayed in this way is easier to recognize, detect and understand. Miglietti holds a very similar positive view of visualization, saying that it is a transformation of data into more understandable visual objects. The most important thing in the process is to maintain a synergistic effect in creating and understanding by users. (Miglietti, 2020) The above information also suggests that the correct display of data is an equally powerful communication tool. Data visualization can be understood as an art and at the same time a science, where a creative connection creates a new comprehensive visual construction, which one can perceive simply, clearly, on a good basis to draw a conclusion and ultimately decide. Different techniques need to be used in mobile devices than in larger digital devices. Basically, the theory implies that it is important to pay particular attention to the screen size. Experts Brych (2018) and on the other hand Magal (2019) say that when creating, we must adhere to the principles of simplicity, purity, and we should have control by pressing the screen. In the theoretical part, we gradually went through SoLoMo marketing and the individual components of social, local and mobile. The following is current research work in the form of research and proving the solution of the problem. The part mentioned in stages then contains the possibilities of data collection, the current state of data collection and analysis in foreign business entities. Data analysis and subsequent visualization are also examined. All excerpts were supplemented by the author's results and the results of the analysis of the issues addressed.

### **3 METHODOLOGY**

The research consists of a study of primary and secondary sources. In the introduction and theoretical part, mainly scientific and professional articles by leading authors from practice and professional literature are used. The mentioned part is enriched with an analysis coming from the professional literature. The scientific method that dominates is work analysis, deduction and comparison. Resources are carefully selected by keywords from leading authors from the youngest possible publication dates. Thus, the topicality of the research is ensured. The practical part of the paper contains quantitative marketing research consisting of a questionnaire survey in printed form. The questionnaire survey reflects the current state of use of data, mobile devices and social media in companies. The questionnaire consisted of a header in the form of basic data about the respondent, followed by 36 questions, of which selected questions were subsequently used to help to achieve the goal. The collection was carried out with the help of a printed form, where the target group of respondents consisted of business entities on behalf of managers who are authorized to decide on data processing as well as internal communication. The researched business entities operate on the territory of Slovakia. The researched area had an even representation in western, central and eastern Slovakia with coverage of all regions. The age of respondents representing business entities ranged from 20 to 67 years. Especially in the male representation, up to 70% (91 respondents) and 30% were women (39 respondents).

The survey was conducted over a period of three months from March 9, 2020 to June 9, 2020. The survey involved 130 business entities on behalf of managers. The research sample was carried out by available selection. The benefit is precisely the broad-spectrum selection, which enables a more comprehensive and extensive conclusion of conclusions on the issue from smaller to the largest business entities. The aim of the research is to clarify the current state of resoluteness through data in the business environment in Slovakia with regard to internal communication through social networks and mobile phones.

This leads to the following hypotheses:

H1: We assume that business entities place predominant emphasis on data.

H2: We assume that more business entities make decisions based on data.

H3: We assume that there are more business entities that know than those that do not know the most important metrics for measuring success.

H4: We assume that there is a difference between the use of social networks and mobile phones in business entities.

H5: We assume that the score will be higher when using mobile phones than on social media

The questionnaire contained the following questions:

*“Do you emphasize data?”*

The question is directly aimed at clarifying the basic essence of whether the management of the company in the form of a manager takes into account the data or not. It is an ordinal variable with the possibility of answering never, sometimes, always.

*“Do you know the most important metrics for measuring success?”*

The question is aimed at respondents who hold positions in the management department of the company with an impact on the operation of the business entity. The question shows whether managers are familiar with the most important metrics for measuring the success of the company. The result is in the form of a nominal variable with options yes and no.

*“Do you feel positive when you have the data to help you make informed decisions?”*

With this question, we find out whether the company’s management appreciates if they have supporting data for decision-making. Motivation in this case can lead to the collection and evaluation of a larger amount and type of data. It is a nominal variable with the possibility of answering yes and no.

*“Are you trying to understand the source of the data and all the issues related to the data?”*

The question defines whether the company’s management is trying to understand the origin of the data, as well as the issues related to the data that lead to analysis and evaluation. It is a nominal variable with the possibility of answering yes and no.

*“Do you make important decisions based on data?”*

The question talks about the orientation of the company’s management to the data and whether important decisions about the direction of the business entity result from them. It is an ordinal variable with the possibility of answering never, sometimes, always.

*“Do you emphasize data-based findings and conclusions?”*

Businesses, even if they collect specific data, do not often have to give weight to the results and conclusions. Despite the collection and visualization of data, decisions can be made intuitively or on an unsubstantiated basis, the question is included in the research to clarify whether it is a

priority for companies to define conclusions from the data. It is an ordinal variable with the possibility of answering never, sometimes, always.

*“Do you use mobile phones, tablets for internal communication?” And “Do you use social media tools for internal communication?”*

Two questions about the use of mobile devices and social media to clarify whether it is comfortable for management and employees to bring and interpret data through data visualization in internal communication. It is a nominal variable with the possibility of answering yes and no.

The evaluation is carried out on the basis of statistical description, specifically by describing the variables of the objects in which the result of the obtained information is stored. The goal can only be met by defining all the variables mentioned. Investigations show results, where the description is important in terms of assessing the relevance of results. In describing the results, the frequency is used appropriately for nominal and cardinal variables. The results in value form are assigned data in the form of frequency, which is applied to the researched research group. The result of the value number is the frequency table. Subsequent analysis of the frequency table is realized with the help of univariate frequency analysis, where individual variables are characterized, used to visualize the number of nominal and ordinal variables. The resultant represents the frequency and percentage expressed by the given formula per result of the percentage of one number from another number:

$$p\% = A/B.100\% \tag{1}$$

Two numbers A and B are given. The percentage is calculated from the number A and is divided by B. It is then multiplied by 100. Subsequently, a nonparametric binomial test is used to accurately test statistical significance and deviation from the theoretically expected distribution observed in two and three categories. The test is suitable for assessing nominal variables.

$$P(B = k) = \binom{n}{k} p^k (1 - p)^{n-k} \tag{2}$$

Where: n is the number of attempts (sample size), k is the number of successes, p is the probability of success of one attempt.

## 4 RESULTS

The following chapter contains interpretations of individual questions from the survey and the resulting conclusions formed thanks to univariate frequency analyses. 130 respondents (100%) are valid for all questions.

Tab. 1 – Frequencies for "Do you know the most important metrics for measuring success?" Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
No	46	35.385	35.385	35.385
Yes	84	64.615	64.615	100.000
Missing	0	0.000		
<b>Total</b>	130	100.000		

The results of the frequency analysis of the variable answer to the question are shown in Table 1. The question was answered by 130 respondents (100%), which is the whole research set. Of these valid answers, the answer "Yes" was the most represented in the frequency of 84 answers (64.615%). The second answer "No" was represented in the frequency of 46 answers (35.385%). The table shows that most businesses know the most important metrics for

measuring success, but there is also a fairly large proportion of companies that do not know the metrics. Hypothesis no. 3 was confirmed and the substance was fulfilled. More businesses know the metrics for measuring success.

Tab. 2 – Frequencies for "Do you feel positive when you have the data to help you make informed decisions?"

Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	130	100.000	100.000	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

Frequency analysis of the variable answer to the question are given in Table 2. The question was answered by 130 respondents (100%) of the complete research set. The answer "Yes" was confidently represented in the frequency of 130 answers (100%). The above table shows that all businesses perceive positively if they have data based on which they could make decisions. This clarification is important because businesses are therefore open to data collection.

Tab. 3 – Frequencies for „Are you trying to understand the source of the data and all the issues related to the data?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
No	7	5.385	5.385	5.385
Yes	123	94.615	94.615	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

The results of the frequency analysis of the variable answer to the question are shown in Table 3. The question was answered by 130 respondents (100%), which is the whole set. Of these valid answers, the answer "Yes" was the most represented in the frequency of 123 answers (94.615%). The second answer "No" was represented in the frequency of 7 answers (5.385%). The table shows that the vast majority of businesses try to understand the origin of the data and other data issues.

Tab. 4 – Frequencies for „Do you emphasize data?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Sometimes	42	32.308	32.308	32.308
Never	4	3.077	3.077	35.385
Always	84	64.615	64.615	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

The results of the frequency analysis of the variable answer to the question are shown in Table 4. The question was answered by 130 respondents (100%), which is the whole set. A 3-point scale was used in the given question. Of the valid answers, the answer "Always" was the most represented in the frequency of 84 answers (64.615%). In second place was the answer "Sometimes" in the frequency of 42 responses (32.308%). And in the third place, the answer "Never" with a frequency of 4 (3.077%) The table shows that most companies always emphasize data, but quarter of them sometimes or never emphasizes data, which is a large percentage of companies that are not interested in data. Hypothesis number one is true. Businesses emphasize data.

Tab. 5 – Frequencies for „Do you make important decisions based on data?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Sometimes	61	46.923	46.923	46.923
Never	3	2.308	2.308	49.231
Always	66	50.769	50.769	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

The results of the frequency analysis of the variable answer to the question are shown in Table 5. The question was answered by 130 respondents (100%), which is the whole set. A 3-point scale was used in the given question. Of the valid answers, the answer "Always" was the most represented in the frequency of 64 answers (50.769%). In second place was the answer "Sometimes" in the frequency of 61 responses (42.923%). And in the third place, the answer "Never" with a frequency of 3 (2.308%) The table shows that half of the companies make important decisions based on data. This is a critical number as the other half makes decisions based on data only sometimes, such decisions may often not lead to success. Hypothesis No. 2 is true, business entities make decisions based on data.

Tab. 6 – Frequencies for „ Do you emphasize data and conclusions based on data?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Sometimes	37	28.462	37	28.462
Never	2	1.538	2	1.538
Always	91	70.000	91	70.000
Missing	0	0.000	0	0.000
<b>Total</b>	<b>130</b>	<b>100.000</b>	<b>130</b>	<b>100.000</b>

The results of the frequency analysis of the answer variable are shown in Table 6. 130 respondents (100%) answered the question, which is the whole set. A 3-point scale was used in the given question. Of the valid answers, the answer "Always" was the most represented in the frequency of 91 answers (70%). In second place was the answer "Sometimes" in the frequency of 37 responses (28.462%). And in the third place, the answer "Never" with a frequency of 2 (1.538%) The table shows that most companies always emphasize data-based knowledge and conclusions, but sometimes or never emphasize data a quarter, which is a large percentage of companies which does not emphasize data.

Tab. 7 – Frequencies for „ Do you use mobile phones or tablets for internal communication?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
No	1	0.769	0.769	0.769
Yes	129	99.231	99.231	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

Frequency analysis of the variable answer to the question are given in Table 7. The question was answered by 130 respondents (100%) of the complete research set. The answer "Yes" was confidently represented in the frequency of 129 answers (99.231%). The above table shows that virtually all businesses use mobile phones for internal communication. Therefore, it is appropriate to prepare the data visualization in this way in the form of a broad-based mobile application. Hypothesis no. 5 has been fulfilled and is correct. Mobile phones scored higher than social media.

Table 8 – Frequencies for „ Do you use social media tools in your internal communication?“ Source: own research

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
No	43	33.077	33.077	33.077
Yes	87	66.923	66.923	100.000
Missing	0	0.000		
<b>Total</b>	<b>130</b>	<b>100.000</b>		

Frequency analysis of the variable answer to the question are given in Table 8. The question was answered by 130 respondents (100%) of the complete research set. The answer "Yes" was confidently represented in the frequency of 87 answers (66.923%). The second answer "No" was represented in the frequency of 43 answers (33.077%). The above table shows that the vast majority use social media in internal communication, but the representation is much smaller than in mobile phones. Therefore, it is better to use a mobile application for visualization. Hypothesis no. 4 was true. We see a difference between social media and mobile phones.

Tab. 9 – Binomial analysis Source: own research

Variable	Level	Counts	Total	Proportion	p	Lower	Upper
"Do you know the most important metrics for measuring success?"	No	46	130	0.354	0.001	0.272	0.442
	Yes	84	130	0.646	0.001	0.558	0.728
"Do you feel positive when you have the data to help you make informed decisions?"	Yes	130	130	1.000	< .001	0.972	1.000
"Are you trying to understand the source of the data and all the issues related to the data?"	No	7	130	0.054	< .001	0.022	0.108
	Yes	123	130	0.946	< .001	0.892	0.978
"Do you emphasize data?"	Sometimes	42	130	0.323	< .001	0.244	0.411
	Never	4	130	0.031	< .001	0.008	0.077
	Always	84	130	0.646	0.001	0.558	0.728
"Do you make important decisions based on data?"	Sometimes	61	130	0.469	0.539	0.381	0.559
	Never	3	130	0.023	< .001	0.005	0.066
	Always	66	130	0.508	0.930	0.419	0.596
"Do you emphasize data-based findings and conclusions?"	Sometimes	37	130	0.285	< .001	0.209	0.370
	Never	2	130	0.015	< .001	0.002	0.054
	Always	91	130	0.700	< .001	0.613	0.777
"Do you use mobile phones or tablets for internal communication?"	No	1	130	0.008	< .001	0	0.042
	Yes	129	130	0.992	< .001	0.958	1.000
"Do you use social media tools in your internal communication?"	Nie	43	130	0.331	< .001	0.251	0.419
	Yes	87	130	0.669	< .001	0.581	0.749

Binomial test results with a proportionality of a maximum of 1 with a significant relationship between the resulting variables. In the first question, the value of the variable "No" with the number of occurrences 46 from the total set of 130 respondents is in the proportional value 0.354 and the answer "Yes" is with the number 84 and the proportional value 0.646. In the following question, the value of the variable is "Yes" with a proportion of 1, which is an absolute proportion. In the next question, the proportion is "No" with a number of 7 at 0.054. The answer "Yes" is covered 123 times with a proportion of 0.946. The following question is covered by the answer "Sometimes" with the number 42 and the proportion 0.323, followed by the answer "Never" with the number 4 and the frequency 0.031. The last answer is "Always" with a number of 84 and a proportion of 0.646. Question 5 is answered "Sometimes" with a number of 61 and a ratio of 0.469. 3 respondents agreed with the answer "Never" and the proportion is at the level of 0.023. On the other hand, the answer "Always" has a representation with a number of 66 and a proportion of 0.508. Question 6 is represented by the answer "Sometimes" in number 37 and a proportion of 0.285. It is followed by "Never" with a number of 2 and a proportion of 0.015. The "Always" answer has 91 answers to this question and a proportion of 0.700. One respondent answered the seventh question "No" with a proportion of 0.008 and the answer "Yes" was in 129 cases with a proportion of 0.992. The last question was answered by 43 respondents "No" with a proportion of 0.331, on the other hand it is "Yes" with a number of 87 and a proportion of 0.669.

## 5 DISCUSSION AND CONCLUSION

The research brought a very important knowledge about the state of the problem in the domestic business environment. The conclusions will serve as a basis for further research, which is very desirable in the field of data and visualization. Data collection in the business environment has been established for a long time. It is a long-term phenomenon, but e-marketing data have huge potential in the future. It is important not only to collect and store data, but also to properly analyse and visualize it. We find application in business entities mainly as a competitive advantage in decision making and also in the field of automation and prediction of the

development of marketing activities. The limits of the survey consist mainly of a smaller sample and representation of random business entities. Distortions could have occurred when executives wanted to appear in a better light and marked a better answer than the real reality of businesses. The current situation in Slovakia has shown that companies are largely aware of the most important metrics for measuring the success of their business and perceive it very positively if they have the data to use them to make decisions. Compared to foreign surveys, there is, for example, France, which in 2019 carried out a similar survey of companies that make decisions based on data. (SRD, 2019) It is clear from the results that in France companies are more often making decisions based on data. It is similar in Spain, where in 2016 the penetration of data use was at a higher level. (SRD, 2016) All defined hypotheses were confirmed. Businesses place a strong emphasis on data. A larger number of business entities decide on the basis of data. The vast majority of businesses know the most important metrics for measuring success. The difference between the use of social media and mobile phones in business entities is large and there is a higher proportion of mobile phones. This finding opens up a number of opportunities for data creators to enable businesses to incorporate the collection, analysis and visualization of marketing, economic and other data. Companies are also trying to understand the data. Therefore, when developing systems, it is important to look for the correct visualization of data as a priority element. The emphasis on data is in the vast majority, but there are still noticeable weaknesses. Therefore, it is important to make the most of data-driven decision-making in the home environment. Such decisions are often very precise and help to a greater extent than decisions made on the basis of intuition. What completes the question of accepting the importance of data where only half of business entities are identified with decision-making based on data. At the same time, the emphasis on knowledge and conclusions based on data is always taken by the vast majority of companies as a regular reality. The finding that the vast majority of people use a mobile phone for internal communication and corresponds to the SoLoMo concept has led to the fact that creating a visualization on a mobile phone can bring constant contact with data and immediate decision-making. Social media has largely confirmed that they are predominantly used. Although companies use education data, it is very important in this regard. The finding that companies want to use data and that they are mainly on mobile devices in internal communication gives us the answer to the fact that the creators of systems for storing, processing and visualizing data have the opportunity to create systems for mobile devices. We will further lead the research direction to clarify the data, which can be measured mainly in the environmental sphere. It is also important to examine and measure the data visualization.

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# MOTIVATION DRIVERS AND BARRIERS OF GENERATION Z AT WORK: MEBS METHOD

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## **Abstract**

Generation Z, the youngest economically active generation in the labour markets, is currently entering its professional life. As with previous generations, representatives of the generation Z (1995-2010) are typical for their characteristics, attitudes or requirements. For companies, the task then arises in the form of identification of these motivational, but also demotivational factors, for effective management and motivation of their employees. The aim of the study is an identification and mutual comparison of motivational factors and barriers in the conditions of the Czech Republic. The research is carried out using the method of empathy-based stories (MEBS), which is based on short fictional stories and works with empathy of the respondents. The research sample consists of 134 respondents who identified a total of 481 items of motivation drivers and 496 items of motivation barriers, which are part of 5 clusters. According to the results, it is clear that the factors include the relationship with co-workers and the atmosphere in the workplace, remuneration and meaningful job. On the contrary, the factors with the least influence can include work-life balance or job security, for which, however, the influence of the structure of the research sample, which consists of university students, is possible. Regarding clusters, the areas of Relationships at work and Work-related factors have the largest share (importance). On the contrary, the least importance is given to the areas of Achievement (Career and Learning) and Out of work (personal) factors. A significant agreement of de / motivational factors was discovered in an international comparison with research based on the same method of data collection.

**Keywords:** *Generation Z, MEBS method, work motivation, motivation barriers*

## **1 INTRODUCTION**

At present, two major tendencies can be observed in the vast majority of Central European labour markets, which influence the formation and behaviour of the labour force on the supply side and enterprises on the demand side. One of the elements is low unemployment, which is a consequence of the economic boom period. At the end of the year, the unemployment rate of the European Union was slightly over 6%, in selected Central European countries the rate was even well below this threshold (Czech Republic ~ 2%; Germany ~ 3%; Slovakia ~ 5%; Poland ~ 3%) (Eurostat, 2020). Such a low level of the labour market represents a fundamental problem for companies in times of economic growth in recruiting and maintaining a workforce. The HR departments of organizations are thus often forced to pay more and more attention to the quality and efficiency of personnel processes.

The second tendency that can be traced in the labour market is the natural movement of the labour force, which is characterized by changes in the number of people of working age (15-64 years). This trend also applies to the Czech Republic, where will be according to Němečková (2019) the decrease in people of working age in the next 30 years by up to about 1 million people (out of the current 6.9 million people). The data show that the older age generations are gradually leaving the labour markets and are only partially replaced by the younger generations. In addition to the aforementioned Czech Republic, this trend is also evident in the surrounding countries - Slovakia, Hungary or Poland. Moreover, the states forming the so-called Visegrad

group are also very similar to the relative representation of individual generations in their population. However, in contrast to the United States, the proportion of the youngest generations Y and Z is not so high in comparison, which contributes to the gradual decline of people of working age over the following years (Mičík et al., 2020).

It is very important for organizations to adapt to gradual changes in labour markets, which are influenced, among other things, by the characteristics and attitudes of the individual generations that make up the labour market. The youngest generation entering the labour market is the generation Z (Gen Z), whose annual anchorage is 1995-2010 (Bencsik, Juhász & Horváth-Csikós, 2016; Issa & Isaias, 2016; Koulopoulos & Keldsen, 2016). It is the knowledge of this new workforce and the adaptation of processes that is the challenge for companies in the coming years. The aim of the paper is to identify the perception of motivational and demotivational factors by representatives of the Z generation in the conditions of the Czech Republic and the subsequent international comparison of these findings.

The paper is organized as follows. First, attitudes and characteristics of the generation Z are described. Next, the method and the research instrument are explained. Then, the study results are report and discuss. Finally, the conclusions and limitations of the study are provided.

## **2 THEORETICAL BACKGROUND**

Generation Z grew up as the first generation in a completely globalized and interconnected world, dominated primarily by information and communication technologies (ICT). Despite the fact that the previous generation of Millennials met ICT in their childhood, generation Z grows up with them from birth and is therefore often called Net Gen, iGen, Digital Natives or Generation C (connected, communicating, etc.) (Baldonado, 2018; Friedrich et al., 2010). Three-quarters of generation Z representatives according to Cision (2013) agree that the relationship and experience in the field of technology help them achieve the desired goal. At the same time, about half of the Gen Z surveyed in the Deloitte survey (Gomez, Mawhinney & Betts, 2018) rated the technology industry as the best for the job. This fact has also a dark side, 40% admitted that they felt to be digitally dependent (Monych, 2017). On the contrary, a positive impact is evident in the area of multitasking. The use of a wide range of devices (visual, auditory, tactile) has ensured that Gen Z has developed the ability to synchronize hands, eyes and ears most in existing human history (Berkup, 2014).

In addition to technology, the formation of this generation also influenced economic and social events, which can include the economic crisis of 2008 (Gomez, Mawhinney & Betts, 2018). This is also reflected in an upbringing, which focuses more on preparing an individual for adult life - independence and responsibility. Parents try to explain things to their children in wider consequences, try increase a communication with children and transfer more responsibility and worries to them. This is confirmed, for example, by the fact that 93% of parents reported that their Gen Z children had an impact on the determination of family expenses. In particular, 65% reported that children influence holiday choice and 32% of parents acknowledged that children's opinion affected the purchase of apartment equipment (Merriman, 2015). Here may be mentioned the difference between Gen Z and older Millennials, for which parents are guardians and constant supporters (including financial support). Millennials expect this form of protection and support from their parents also in adulthood. For example, after graduating from college - roughly one in four at the age of 25-34 lives still with their parents (Merriman, 2015).

Regarding the most important work motivation factors, research agrees mainly on three factors: financial security, career opportunities and meaningful job (Gomez, Mawhinney & Betts, 2018; Half, 2015; Wiedmer, 2015; Schawbel, 2014). Career opportunities are also associated with the

area of employee development, which is gaining in importance due to the fact that generation Z is becoming the most educated generation ever (Adecco, 2019).

Other factors include the need for flexibility, with which, according to ManpowerGroup (2016), companies can ensure the retention of young talent. Sidorcuka and Chesnoviska (2017) also identified with this, according to whose research the flexibility of time and work belongs to the requirements of employees that should be respected. The need for time flexibility is also related to the fact that Gen Z is ready to break the boundaries between work and leisure (Henley, 2019).

Regarding the expectations of employers from the Z generation, Kutlák (2020) in his research came to the following facts, which are more in line with those described above. According to employers, the main motivational factors of the generation Z include: Flexibility of working hours; Rewarding, Meaningful job; work-life-balance or Attractive workplace culture. As for the clusters themselves, the highest rated areas were Learning and Career Development and Social and Corporate Atmosphere.

### **3 METHODOLOGY**

The research framework is based on studies according to Kultalahti and Viital (2014) or Fratričová and Kirchmayer (2018a). Studies are focused on the identification of work motivation and demotivation factors according to generation Y in Finland and generation Z in Slovakia. The aim of this qualitative research is to collect and identify factors that positively and negatively affect the motivation of representatives of the generation Z in the Czech Republic. Specifically, these are students of the Faculty of Economics in Pilsen, who were born between the years 1995-2010. Despite the fact that the sample of respondents is very narrow and not large (134 valid answers), for mutual international comparison of the resulting data with previous research, especially with research according to Fratričová and Kirchmayer (2018a, b), the sociodemographic sample data are very appropriate.

For the purposes of this article, the following research questions have been established: What factors and areas motivate generation Z representatives in the work environment? What factors and areas demotivate representatives of the Z generation in the work environment?

The above research questions are asked at the present tense, despite the fact that most respondents are not fully involved in professional life. However, only 13 respondents had no experience with a paid job or internship in the last six months. It should be noted that full-time work is often associated with other social milestones (own housing, starting a family, etc.) and can influence the thinking of respondents. At the same time, the present tense was used due to the method of data collection used. The method of empathy-based stories (MEBS) was used for research purposes.

The MEBS method is one of the qualitative methods of data collection and is similar in content to the fictional narrative role-playing method. The method began to be used more frequently in the 1980s in Finland and is now used worldwide for various sciences (Wallin, Koro-Ljungberg & Eskola, 2019; Posti-Ahokas, 2013; Eskola, 1991). The MEBS method is based on writing short fictional stories, which are formed on an introductory story forwarded by the author of the research himself. An introductory story is a brief presentation of an event or situation to which respondents respond or complete. The method is based on the expectation that the research participants empathize with the story and therefore respond based on their own beliefs. The method according to Gerace et al. (2013) also works with elements of the empathic process including the concepts of emotional empathy, personal anxiety, sympathy or antipathy. As mentioned by Wallin, Koro-Ljungberg and Eskola (2019), in the MEBS method we rather encounter applied empathy, which does not necessarily require empathic feelings.

Respondents were presented with 2 stories, one of which was positive and the other was negative. The aim of a positive story is to identify motivational factors in the work environment. The negative story focused on barriers of motivation in the work environment. The stories were based on research by Fratričová and Kirchmayer (2018a, b), and Kultalahti and Viitala (2014), while it was translated into Czech and one of the typical Czech names Vlasta was added to the story for easier identification with the presented story. The wording of the name in the Czech language is also gender neutral and allows both sexes to have the same level of empathy.

*Positive story: Imagine that Vlasta returns from work one day. He feels motivated and has a lot of energy for further work. He doesn't mind getting up to work, he is even always looking forward to the next working day. What is behind the fact that Vlasta feels so motivated and so excited about his work?*

*Negative story: Imagine that Vlasta returns from work one day. He feels tired and has no enthusiasm for further work. Vlasta is not looking forward to the morning when he has to get up to work again. The only thing he looks forward to is a free weekend. What is behind the fact that Vlasta feels so demotivated from his work and why does he lack enthusiasm?*

For the purposes of this research, the distribution of data through online forms was used. This method is no obstacle for the representatives of the generation Z, otherwise known as the Internet generation. The questionnaires were distributed among students of the University of West Bohemia in Pilsen, Faculty of Economics. A total of 134 respondents with births from 1995-2002 took part in the survey. Respondents with the year of birth in 1998 (41%) had the largest representation, followed by the year of birth in 1999 (34%) and 1997 (11%). All respondents answered both stories. The answers were recorded in the form of a list of items or in the form of a continuous text. The results were subjected to content analysis, which can be described as a subjective interpretation of the content of textual data through a systematic sorting process of coding and identification of topics or patterns (Hsieh & Shannon, 2005).

Factors and clusters according to Fratričová & Kirchmayer (2018a, b) were used to code the answers from the content analysis. Based on the coding in the content analysis, 481 factors were obtained for the positive story and 496 factors for the negative story. On average, less than 4 factors were decoded for each respondent for each of the stories. Using content analysis as described above, 23 positive factors and 26 negative factors were saturated with at least one response. These factors are based on the factor clusters model below, which consists of 3 main pillars (Employee, Job and Organization) and 5 clusters are based on them.



Fig. 1 – Model of clusters. Source: Fratričová & Kirchmayer (2018a, b)

## 4 RESULTS

The results of the comparison of the clusters themselves (see Table 1) indicate that in both analysed stories, the "Relationships at work, Work, Work-person" belong to the most mentioned clusters. These three areas make up about 85-90% for both stories. The minor parts then form clusters Achievement and Out of work factors.

Tab. 1 – Clusters ranking by relative share. Source: own research

Cluster	% of items	
	Positive	Negative
Relationships at work	28%	37%
Work	28%	28%
Work-person	28%	24%
Achievement	12%	7%
Out of work	4%	5%

The area of workplace relations is one of the most mentioned in both stories. The positive story was mainly about answers focusing on a good work team. At the same time, this answer was the most frequently mentioned factor - 78% (see Table 2). Another factor in Vlasta's employee motivation was the leadership factor. Respondents consider this cluster with 37% to be a fundamental barrier to the Vlasta's motivation. In the answers, factors related to the work team (61%) and relationships with the superior (30%) were most often marked (similarly to the positive story). At the same time, factors in the form of conflicts with co-workers or bullying were mentioned in 19% of respondents.

The cluster focusing on work factors is comparable in the relative number of mentioned factors in both analysed stories (equally 28%). In the case of a positive story, the most frequent answer with 55% was the area of wage remuneration, specifically in the form of wage increases or the award of bonuses. 45% of respondents included low / inadequate wages as barriers to motivation for a negative story. A total of 28% of respondents also mentioned the issue of a large number of tasks and their possible complexity, 16% consider the appearance or equipment of the workplace to be a barrier to motivation.

The third most frequently mentioned area is the cluster focusing on the work-person relationship. 57% of respondents cited the reason for Vlasta's positive emotions by the fact that he enjoys and likes the work he or she does. In second place, the factor expressing the fact that the worker performs work that interests him and whose content fills him, placed with 18%. On the contrary, according to the respondents, the factor that contributes to demotivation is the content of the work performed (39%). Other barriers to motivation were identified as the meaning of the work performed (19%) and the lack of autonomy at work (16%).

In the achievement cluster, 3 factors were identified in the positive story of Vlasta's employee: Achievement; Recognition and Career advancement. The evaluation of all the above factors is very identical, between 12-17%. Inverse factors were also identified in the second story, namely Poor performance, Career stagnation and Lack of recognition. Factors were mentioned in answers by about 7-10% of respondents. It is the lower incidence in responses to barriers of motivation that affects the overall share of this cluster (7%), in contrast to the 12% share in the inter-cluster comparison of the positive story of the employee Vlasta.

Almost the same share (4-5%) for both stories belong to the areas of factors marked out of work, which are related to the employee, but not in direct relation to the work or the company. In both stories, these are answers that indicate the employee's de / motivation, which stems from personal life (health, family, friends) or is the result of the current distribution (physiological factors).

Table 2 below lists the 10 most frequently mentioned de/motivational factors from both analysed stories. At the same time, the outlined answers outlined are inverse to each other, so they were identified as both a motivational and a demotivational factor, of course due to the opposite meaning (e.g. high / low wage). These factors can be identified as very important, as they evoke both positive and negative emotions in the respondents.

Tab. 2 – Clusters ranking by relative share. Source: own research

Motivational factors (positive story)			Demotivational factors (negative story)		
Factor	Nominal item prevalence	% of respondents (N=134)	Factor	Nominal item prevalence	% of respondents (N=134)
<b>Co-workers</b>	104	78	<b>Co-workers: Team climate</b>	82	61
<b>Meaningful job</b>	77	57	<b>Reward</b>	60	45
<b>Reward</b>	74	55	<b>Does not enjoy his work</b>	52	39
<b>Leadership</b>	30	22	<b>Leadership: Relationship</b>	40	30
<b>Work of interest</b>	24	18	<b>Leadership: Bad leader</b>	29	22
Achievement	23	17	<b>Lack of sense of purpose</b>	25	19
Workplace	22	16	Workload	24	18
Recognition	20	15	Lack of autonomy	21	16
<b>Impact</b>	18	13	Co-workers: Conflicts	19	14
Career advancement	16	12	<b>No interest in work</b>	15	11
Remaining factors	63	<6 each item	Remaining factors	129	<11 each item

### International comparison

The comparison of the outputs from the content analysis with the research of Fratričová & Kirchmayer (2018a, b) applying the same method to a very similar sample of respondents (university students - Faculty of Economics) is shown in Table 3 below. There are noticeable differences in motivating elements, especially in the issue of workplace relations and the issue of achievement. Differences in demotivational factors also apply to the same areas. In addition, greater differences can be observed in demotivational factors also in the area of Work-person.

Tab. 3 – Clusters ranking in selected countries. Source: own research; Fratričová & Kirchmayer (2018a, b)

Clusters	CZE		SVK	
	% of items		% of items	
	Positive	Negative	Positive	Negative
Relationships at work	28	37	16	26
Work	28	28	24	24
Work-person	28	24	29	37
Achievement	12	7	20	9
Out of work	4	5	7	4

When comparing specific factors, it can be identified that in both countries, the biggest de / motivational factors are Co-workers, Meaningful work and Reward. Significantly higher shares

within the motivational factors were achieved in Slovak research by items related to personal and career development. On the contrary, Czech respondents more often mention the issue of meaningful of job and leadership. With regard to demotivational factors, it is possible to note on the Czech side a higher importance of the relationship with the superior and the way of his management, which are replaced on the Slovak side by the sensuality of the work performed or the poor performance of the employee.

## **5 DISCUSSION AND CONCLUSION**

The aim of the paper was to identify the factors that support the motivation or demotivation of the generation Z. A qualitative method of empathy-based stories (MEBS) was used for the research. The qualitative nature of the research aims, based on storytelling, to reveal possible hidden unique factors.

Based on the above outputs, it is clear that the identified motivational factors in the form of Meaningful work and Reward agree with the presented research (Gomez, Mawhinney & Betts, 2018; Half, 2015; Wiedmer, 2015; Schawbel, 2014). However, discrepancies can be observed in the area of Co-workers (relationships with colleagues, atmosphere, etc.). Although research puts this factor first, these studies have not identified this factor as important. However, according to Kutlák (2020), the position of this factor is in line with the expectations of employers from the generation Z. In the mentioned research, the factor Attractive workplace culture, respectively the area of Social and Corporate Atmosphere is according to HR managers one of the most important for individuals from the examined generation Z.

According to ManpowerGroup (2016), Sidorcuka and Chesnoviska (2017) and Henley (2019), the needs of generation Z also include flexibility, which can relate both in terms of time and, for example, the performance of tasks. However, in the presented research, the item Work-time was mentioned in the positive story by 5% of respondents, in the negative by 6%. Only 1 respondent mentioned the related issue of Work-life-balance in the positive story, none in the negative one. However, it should be noted that despite the fact that a large proportion (90%) of respondents reported at least partial work experience, they are still university students with a median age of the sample of 21 years. It is therefore possible that the growing interest in this area will be possible to observe in the individuals only in connection with starting a job.

A similar limitation by the current status of respondents may also affect the position of the Achievement cluster, which includes career growth or personal development. Students often may not feel at present and therefore reflect the need for further education or development. This area makes up only 12% of the presented research, in contrast to the outputs according to Wiedmer (2015) or Schawbel (2014). According to Kutlák (2020), even the area of Education and Careers is or will be, based on the expectations of employers, the most important for the generation Z.

Due to the fact that the MEBS method works on a qualitative basis, it is appropriate to subject the obtained results to quantitative verification, which can, based on deeper statistical processing, validate the presented results. The present research has certain limitations. First, as mentioned above, the size and nature of the sample is due to the fact that the outputs obtained cannot be generalized. Furthermore, the coding process of content analysis is slightly influenced by subjectivity, which may have an impact on the outputs or on the comparison of similar studies, despite the use of the same method of data collection. Finally, the data used are influenced by the age of the respondents, especially in the younger representatives of the generation Z.

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# EXPLORING CUSTOMERS' E-LOYALTY IN CZECH B2C E-COMMERCE

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## **Abstract**

The e-commerce market is a turbulent environment where competition is intensifying fast, barriers to enter the market are low and so are the customers switching costs. By several authors, one of the keys to run a successful business is to enhance customer loyalty. Also, several authors claim that building customer loyalty does not bring the desired effect. The purpose of the article is to bring a closer view of customer purchase behaviour in Czech B2C e-commerce and investigate the existence of e-loyalty and its influence on e-stores revenues. The aim of the paper is to examine the role of e-loyalty in the area of Czech B2C e-commerce. There was made explorative research focused on customer e-loyalty. The research has the role of preliminary research. The subject of the research is chosen e-stores' customers. Collected data include their amount, number of purchases they made in 2 years period, purchase frequency, and sales volume. The objects of the research are Czech SME companies operating in the e-commerce market through e-stores. In the literature review, there were found different attitudes towards customer loyalty and its importance for business results. To examine the role of e-loyalty, authors also used a Pareto analysis. Then, authors analysed number of purchases made by the majority of the customers and the sales volume they generated. From obtained results, authors found out that the Pareto principle cannot be applied for chosen e-stores. Authors also found out that the majority of customers are one time buyers. This group of customers also generated the largest part of the sales volume. These facts put a question mark on the importance of e-loyalty in the Czech e-commerce market. The limitation of the research is the amount of data since there were just three e-stores included. Hence, authors will make future research with a bigger sample to further examine the role of e-loyalty in the Czech B2C e-commerce market.

*Keywords* e-commerce, customer, loyalty, e-loyalty, e-store

## **1 INTRODUCTION**

The e-commerce market is significantly growing every year, in 2019 it amounted to 3,53 trillion USD and it is forecasted to grow to 6,54 trillion USD in 2022 ("Retail e-commerce sales worldwide from 2014 to 2023", 2020). Its growth was also boosted by COVID 19 influence when companies needed to transfer their sales activities to an online environment which strengthen the competition in the e-commerce market. Growing competition increases the importance of understanding customers' needs, delivering adequate value and offer an appropriate portfolio of products and services. Also, it includes a focus on improving service quality and satisfaction. In this context, there is also a need to take into consideration the importance of customer loyalty. In the Czech Republic, all of the above is even more important since there is the biggest amount of online shops per customer in the Czech e-commerce market. Year-over-year, there is a 15% growth in the Czech e-commerce sales, 4% growth of the amount of e-store and 1,3 % growth of the share of e-commerce sales in the total retail turnover and Czech Republic has the biggest number of e-stores per capita ("Česká e-commerce", 2020).

To deal with this situation, some researchers encourage companies to focus on e-loyalty since the loyal customer is one of the keys to profitable business (Chou, Chen, and Lin, 2015; Li et al., 2015; Reichheld et al., 2000a). On the other hand, there are not enough empiric studies that

would support the existence of customers' e-loyalty in e-commerce retail and prove its influence on increasing profit. The lack of evidence-based studies could also be applied to Czech e-commerce. Several authors question the importance of e-loyalty and suggest that majority of the customers are light buyers. Based on these findings, this article will try to research the role of e-loyalty in the context of Czech online stores by analysis of the data collected from Czech e-stores.

The article aims to evaluate the results of qualitative research focused on customers' e-loyalty in Czech e-commerce. The results of the research based on secondary data collected from three Czech B2C e-stores will be presented. There was made a literature review of papers focused on customer behaviour, loyalty and e-loyalty. Based on the review, there were defined four research questions. Two of the questions were evaluated with Pareto analysis. Other research questions focus on repeat purchase behaviour and its influence on e-stores turnover. The authors will analyse customers' purchase frequency and sales volume they make.

## **2 THEORETICAL BACKGROUND**

Customer loyalty as an object of scientific research has its origins in relationship marketing which replaced transaction-oriented concept (Kotler, 1990). In the early stages of customer loyalty research, it was understood as a repeat purchase behaviour (Srinivasan, Anderson, Ponnnavolu, 2002). Later, researchers suggested that this definition is insufficient because it contains just a behavioural approach that does not make a difference between true loyalty and spurious loyalty which could be caused by a lack of purchase alternatives (e.g. Day, 1969; Berkowitz, Jacoby and Chestnut 1978). According to Oliver (1997, 1999) loyalty is "a deeply held commitment to rebuy or repatronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behaviour." To improve the understanding of customer loyalty Engel, Blackwell, Roger and Kollat (1982) extended the definition and formulated it as "the preferential, attitudinal and behavioural response toward one or more brands in a product category expressed over a period of time by a consumer." Oh and Parks (1997) define three approaches towards loyalty: behavioural, attitudinal and integrated. The behavioural approach is based on a tendency to repeat a purchase. The attitudinal approach involves the customers' psychological involvement, favouritism, and sense of goodwill towards a particular product or service (Chang, Wang, Yang, 2009). The integrated approach is a combination of the two mentioned above. To understand the complexity of customer loyalty there is a need to examine both behavioural and attitudinal features (Lee, 2002; Santouridis, & Trivellas, 2009). Besides, Söderlund (2006) added repatronage intentions and word-of-mouth intentions as features of customer loyalty. For a relevant examination, there is also a need to specify loyalty and separate it as brand loyalty, store loyalty or a product loyalty (Devaraj, Fan, & Kohli, 2003). In this article, the main object of the research is e-loyalty. The importance of increasing customers retention is supported by studies suggesting it is more cost-effective to retain a customer than to acquire one (Leefflang, Wittink, 2000; Reichheld, 1994; Rust, Zahorik, Keiningham, 1995).

Another supportive theory for the importance of customer loyalty is a Pareto ratio which, applied in the marketing context, says that 80% of revenue/profit is made by 20% of customers (Cheng, Zhang, Wang, 2006, Kim, Sing, Winer, 2017). Connected to this theory there is a belief that loyalty programs can enhance customers' loyalty which leads to building a customer base continuously repeating purchase and generating around 80% of the company's revenue (McCall, Voorhes, 2010). Weinstein (2002), suggests that companies must focus on customers'

retention through delivering superior value to the most valuable customer segment and build a long-lasting relationship based on the existence of the Pareto ratio.

### **E-loyalty**

Reichheld et al. (2000b) have indicated that the notion of e-loyalty is the most important factor affecting online business performance. E-loyalty is based on a similar principle as an “offline loyalty” and has a lot of common features, yet there are some specifics that need to be taken into consideration when it is examined and understood. One of the most influencing factors in e-loyalty is the fact that there are much lower switching costs when purchasing than in brick and mortar stores (Yen, 2011). Simply said, in e-commerce, customers are just one click away from a competing e-store (Gommans, Krishnan, Scheffold, 2001). Even with such low switching costs compared to offline retail, there does not have to be a lower loyalty intention. A comparison of loyalty intentions in online and offline purchases was an object of research by Devaraj, Fan, and Kohli (2003, p. 190), who bring a statement that “customer loyalty toward online shopping and online stores was significantly higher than their loyalty toward conventional shopping and stores. This is contrary to arguments that low switching costs lead to low loyalty to online stores. We find evidence that online shoppers exhibit a high degree of channel loyalty, and web technologies that make the customer interaction a compelling experience reinforce their loyalty.” Yet, this statement was based on a study that contains just questionnaire research with 134 respondents thus it is questionable whether the outcome of this research can be found relevant. Still, there is a strong need to understand customer loyalty in e-commerce and define its importance for companies. The basic definition of e-loyalty by Cyr, Hassanein, Head and Ivanov (2007) sees e-loyalty as an intention to revisit a website or to make a transaction from it in the future. This definition contains just behavioural approach so to cover the complex of e-loyalty, there is a need to examine other definitions, which are more developed. For example, Srinivasan, Anderson and Ponnnavolu’s (2002) definition of e-loyalty says that e-loyalty is a customer’s favourable attitude toward the e-retailer that results in repeat buying behaviour, which also includes an element of the attitudinal approach. Flavián et al. (2006) added a factor of non-switching to other e-tailers and define e-loyalty as a consumer’s intention to buy from a website, and that consumers will not change to another website. This definition is supported by Chou, Chen, and Lin (2015) who denote e-loyalty as a commitment to consistently revisit a website because of a preference for shopping on that website without switching to other websites. All the definitions above contain a behavioural or attitudinal approach but none of them includes a clear measurable aspect so it is found beneficial to mention a definition by Neal (1999) which says that e-loyalty means the proportion of times a purchaser chooses the same product or service in a specific category compared to the total number of purchases made by the purchaser in that category, under the condition that other acceptable products or services are conveniently available in that category. According to these definitions, e-loyalty leads to an improvement in customer retention which could reduce marketing costs and increase profit (Sheth, 1995; Devaraj, 2003).

### **Questioning the importance of customer loyalty and related marketing activities**

From the given literature review it is clear that there is plenty of researchers who examine loyalty and e-loyalty and give it a significant role and importance in marketing activities made by companies. On the contrary, there are some studies which offer a different point of view. For example, some researchers have warned against trying to build a long-lasting relationship because if there is a lack of understanding the customer needs, it could end up in annoying customers (Fournier, Dobscha, Mick, 1998; Villanueva, Hanssens, 2007). Another point of view to building relationships with customers which is intended to lead to customer loyalty is that it includes operational costs for managing them. Rigby, Reichheld and Schefter (2002)

suggest that some companies do not know how to manage relationships with customers which leads to negative returns of investments connected loyalty strategies. In the context of using loyalty programmes to increase customer loyalty and profit Dowling and Uncles (1997) made a research in which one the finding was that in the majority of cases all that a customer loyalty program will do is cost you money to provide more benefits to your customers—not all of which will be relevant to the brand’s value proposition and/or positioning. It is unlikely to significantly increase your relative proportion of loyal customers, or your profitability. This point of view is also supported by Meyer-Waarden and Benavent (2006) who found out that loyalty programmes do not always lead to improved loyalty and it does not increase a market share. Loyalty programmes can increase e-stores’ profit only if they are well designed according to both, marketing strategy and customers’ needs since they often do not bring a positive effect on profit and are hardly understandable for customers (Tahal, 2014). Another view to the profitability of loyalty supporting activities is made by Graham (2002) who states that “loyal customers will often be less profitable. One reason for this is that they may expect a reward for their loyalty. This may be in the form of a price discount (for accumulated volume) or extra free services.” Another argument for questioning the importance of loyalty and repeat-purchase supporting marketing activities is that the largest part of the customer base is often light buyers (Romaniuk, 2011). Repeat-purchase behaviour as one of the effects of customer loyalty increases with an increase of a brand’s market share and other way around (Ehrenberg, 1990), which means that an increase of repeat-purchase behaviour is also made by growing a market share. Knowing this, brands should enhance their acquisition activities to grow their market share. The positive correlation of the market share and purchase frequency is also supported by Sharp (2016), who also proved that the majority of the customer base is light buyers and suggest that investing into already committed buyers is cost-ineffective and should not be put in front of the acquisition of the new customers or customers who did not purchase in a long time.

Considering this conflict of different attitudes toward loyalty there is a need to bring evidence-based research to get a better knowledge of the influence of e-loyalty to business results. Also, there is a lack of research applied to e-commerce in the Czech Republic based on data from e-stores since the majority of the studies were based on interviewing consumers. In this article, the data from three e-stores were analysed.

### **3 METHODOLOGY**

The aim is to analyse customer purchase frequency, purchase volume and sales volume in the context of customer loyalty. To meet the aim of the paper, authors made explorative research focused on customers’ e-loyalty. This method was chosen because authors do not have enough data about this problematic. Explorative research provides a better understanding of the problematics and helps to specify the direction of the research or to find an alternative way to examine the topic (Kozel, 2011).

#### **Research object and data collection**

The object of the research is SME companies defined in Annex 1 of Commission Regulation (EC) No 800/2008 of 6 August 2008. Chosen e-stores operate on the Czech e-commerce market through e-stores. As a sufficient criterion, the number of employees was taken into consideration.

For purpose of this article, secondary data was collected from three B2C e-stores for a period of two years. Data was exported from e-store platforms and include the number of customers, number of purchases, purchase frequency and sales volume in Czech crowns. The total amount of the customers included in data collection was around 10 thousand. Each of the chosen e-

stores belongs to a different product category – fashion, electronic and pet supplies. The data was collected for years 2018 and 2019.

### Research questions and their evaluation

In the literature review, there were found authors who used a Pareto analysis as a tool to measure and evaluate customer loyalty. Among other findings, these studies suggest that 20% of most loyal customers make 80% of the company’s turnover. Thus, RQ1 and RQ2 were developed to analyse, what sales volume is made by 20% of most frequent buyers and 20% of most spending buyers. For the purpose of this article, e-loyalty is measured by purchase frequency and purchase volume. To evaluate the importance of e-loyalty for chosen e-stores, authors analysed how frequently the majority of customers make a purchase and what sales volume is made by the majority of the customer base.

Four research questions were developed based on a literature review which are:

RQ1: “What sales volume is made by 20% of most frequent buyers?”,

RQ2: “What sales volume is made by 20% of most spending buyers?”,

RQ3: “What is the purchase frequency of the majority of the customer base?”

RQ4. “What sales volume is made by a majority of the customer base?”.

The first two research questions were evaluated with the application of Pareto analysis. It is a well-known and common method in marketing management, although according to Koch (2007) there is still space for deeper exploration. Pareto's 80/20 rule states that, for example, 80% of what can be achieved with 20% of the time spent or resources used. 80% of outputs are due to 20% of inputs, 80% of consequences are affected by 20% of causes. In business and commerce, the validity of the rule has been confirmed in many cases. E.g. 20% of products bring 80% of turnover. The same applies to customers (Koch, 2007, p. 17). The other two research questions were connected to repeat purchase behaviour and its influence on e-stores’ turnover.

## 4 RESULTS

The aim analysis aimed to find out what share of sales volume is generated by 20% of the most frequent buying customers and what sales volume is generated by 20% of the heaviest spending customers. Then it was analysed how many purchases were made by the majority of the customers and what sales volume was made by this part of the customer base. The results are available in table 1.

Tab. 1 – Results. Source: Own research

RQ1 – RQ4	Fashion	Electronics	Pet supplies
What sales volume is made by 20% of the most frequent buyers?	28%	26%	34%
What sales volume is made by 20% of most spending buyers?	46%	44%	57%
What is the purchase frequency of the majority of the customer base?	1 (93%)	1 (95%)	1 (87%)
What sales volume is made by the majority of the customer base?	84%	91%	78%

From the data analysis, authors found out that 20% of most frequent buyers made 28%, 26%, and 34% of total sales volume. These results significantly differ from the general definition of Pareto analysis which suggests the 20/80 ratios. The sales volume made by 20% of the most frequently purchasing customers is far from 80%, actually, in all three cases, it is more than

twice lower than 80%. Thus, the Pareto ratio cannot be applied here and from the purchase frequency point of view, the most loyal customers make just about a third of the total turnover.

The turnover made by 20% of most spending buyers is in all three cases higher than turnover made by 20% of most frequent buyers but still, none of the results reached 80%. Thus, the Pareto ratio cannot be applied here as well. Turnover made by this group of customers is about 50% of the total sales volume in all three cases. Hence, the managerial implication is that 20% of most spending customers make a bigger total sales volume than 20% of most frequently purchasing customers. Also, it is necessary to take into consideration the costs connected to purchases and delivering the product.

Since the purchase frequency was considered as one of the factors of e-loyalty, authors analysed how often customers make a purchase. In all three cases, the majority of customers (93%, 95%, 87%) made just one purchase in two years. Thus, according to these findings, most of the customers are not loyal to the seller. It also needs to be considered, that all of the chosen e-stores sell products which are generally purchased quite often. Despite this fact, none of the e-stores registered repeat purchase behaviour in 93%, 95% and 87% of customers when only 7%, 5% and 13% of customers made more than one purchase in two years which means that there were not found signs of e-loyalty.

To evaluate the influence of customer loyalty, authors analysed, what sales volume is made by the majority of customers. In all three cases, the majority of customers made one purchase in two years period. This group of customers also made the majority of sales volume (84%, 91%, 78%). Thus, the sales volume made by customers who make more than one purchase in two years is 16%, 9% and 22%. Results have shown that the influence of repeatedly purchasing customers on the total turnover of analysed e-stores is significantly lower than one-time buyers' influence. From this point of view, e-loyal customers are not considered as a key factor of sales volume generation.

## **5 DISCUSSION**

From the results, it is clear that the Pareto ratio does not apply for chosen e-stores in neither purchase-frequency or purchase volume aspect which means that either 20% of the most frequent purchasing customers and 20% of the heaviest spending customer does not generate 80% of sales volume.

RQ1 and RQ2 were connected to the Pareto ratio and the aim was to find out what sales volume is made by 20% of most frequent (RQ1) and most spending (RQ2) buyers. Neither of the chosen e-stores registered a sales volume from most frequent buyers bigger than 34%. Also, neither from chosen e-stores registered a sales volume from most spending buyers bigger than 57%. From this point of view the Pareto ratio cannot be applied. Some studies suggest that there is a difference in sales concentration between online and offline distribution channels. This fact was confirmed by Brynjolfsson and Simestera (2011). Authors point out there is lower sales concentration in the e-commerce market since customers have a much wider choice of different e-stores with lower switching costs compared to offline distribution channels. Also, several authors suggest that in the era of the modern economy, the well-known Pareto principle (Rule 80/20), both in the traditional and Internet dimensions, loses its significance and becomes an economic myth concerning many industries and business sectors (Stepnicka, 2014).

RQ3 questioned the purchase frequency of the majority of the customer base. In all three e-stores, the majority of buyers (87%, 95%, 84%) made just one purchase in two years. Then RQ4 questioned a sales volume made by the majority of the customers (customers who made one purchase per research period) which was 78%, 84% and 91%. Results have also shown that

the majority of the customers make a purchase just once in 2 years and that this segment of the customers also generates a major share of sales volume.

Limitations of the research are a small sample of e-stores so there is a need for new research with a bigger sample since this was preliminary research aimed to point out possible research problematic. On the other hand, the total amount of the customers included in data collection was around 10 thousand. Another limitation of the research is a fact, that research did not take into consideration analysed e-stores' marketing strategies and coherent actions. Still, obtained results put a question mark on the existence and importance of e-loyalty in Czech B2C e-commerce and it is necessary to make more detailed research in this field based on empiric data from e-stores which will be authors' future research focus. Given some of the above-mentioned studies (Brynjolfsson, Simester 2011 and Stepnicka 2014), it would be appropriate to carry out follow-up research on a larger sample of respondents to either identify or refute the views. This pilot research does not yet allow this.

## 6 CONCLUSION

The literature review proposed provides different points of view on customers' loyalty in general and also customers' e-loyalty and its influence on sales volume. Some of the authors suggested that it is important to focus on customers' loyalty/e-loyalty which leads to repeat purchase behaviour and an increase of business results. On the other hand, there were found other authors who conflict with this attitude suggesting that loyalty/e-loyalty depends more on business market share than businesses' marketing activities such as loyalty programmes etc. and pointed out that majority of the customers are light buyers.

Authors defined four research questions and made research based on data collected from three e-stores. This preliminary research did not confirm the validity of Pareto principle 80/20 in neither 20% of most frequently purchasing customers (28/20, 26/20, 34/20) or 20% of most spending customers (46/20, 44/20, 57/20). There are different attitudes towards the application of the Pareto principle among the researchers and differences also occur between online and offline environments. Still, the results of this research suggest that the Pareto principle in its original version cannot be applied in the Czech B2C e-commerce market.

The results suggest that the majority of the customers (93%, 95%, 87%) who also generated the biggest sales volume (84%, 91%, 78%) are one-time buyers. Hence, from behavioural perspective of e-loyalty which focuses on repeat purchase behaviour, signs of e-loyalty were not found among the majority (93%, 95%, 87%) of all chosen e-stores' customers. There are different possible causes of low purchase frequency such as for example electronic shopping barriers either on the e-stores' or customers' side, low level of trust, service quality or satisfaction, customers' attitudes, low customers' switching costs or competition offers. The existence of the above-mentioned and other possible causes leading to a reduction in the rate of repeat purchases could be the cause of e-shops' barriers in building behavioural customer loyalty.

Also, the majority of the sales volume (84%, 91%, 78%) was made by one-time buyers. Thus, the importance of behaviourally loyal customers is not significant for any of the chosen e-stores since the majority of the sales volume was made by one-time buyers. To prove the influence of behaviourally loyal customers on profit, it would be necessary to also include e-stores' transaction costs. Still, these findings bring a need for future research based on empiric e-stores' data to examine customers' e-loyalty in the Czech B2C e-commerce market and its influence on e-stores' business results.

The size of the research sample does not authorize us to join either the group of supporters or critics of the Pareto principle application and either of the group of e-loyalty's supporters or critics. A more qualified conclusion will be made by the following research including a statistically significant sample of e-stores. Still, the problematics of e-loyalty is yet to be explored and interests many authors to examine it. Our future research will focus on the examination of the e-loyalty's existence, role and importance in the Czech B2C e-commerce market.

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# HEALTH RISKS OF BUYING IMPORTED TOYS

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## **Abstract**

The presented paper deals with the characteristics and mapping of health risks of the purchase of imported toys. The first part of the work includes a literature search, which aims to clarify the basic concepts such as risk, dangerous product, risk analysis, phthalates, Safety Gate, Customs Administration, Czech Trade Inspection Authority and EUIPO. The second part of the work already contains an interpretation of the achieved results, where based on the analysis of data, it compares risk factors in selecting toys. Reporting a dangerous product to the Safety Gate system is described here, and thanks to descriptive statistics, the types of hazards in the toy category are processed and compared. The flowchart shows the process of selecting toys. The conclusion of the paper is a summary, and possible measures are suggested.

*Keywords: risks, toys, Czech Trade Inspection Authority, Safety Gate, phthalates*

## **1 INTRODUCTION**

The motivation for the elaboration of the paper was to popularize the given issue and thus start a society-wide discussion about the health risks of imported toys. In today's globalized world, the market is saturated with many products that pose a health risk to consumers. The area of toys was selected within the conclusions reached in the ongoing research. Toys dominate several statistics regarding toy counterfeiting and product hazards. The substances contained in toys are frequently toxic and can have severe effects on children's health. The degree of the insidiousness of these substances lies in the fact that the manifestations of the organism's intoxication are not observable immediately after exposure. The effect of these poisons can be observed only after a long-time horizon. Society frequently downplays the effects of these substances and does not take them as a severe problem.

The main goal of this paper is to map and characterize the health risks of imported toys. Furthermore, the paper clarifies the functioning of the Safety Gate system (RAPEX) and acquaintance with institutions protecting consumers. The work includes developments in the field of societal perception of harmful substances in toys. Also, it aims to acquaint readers with the reporting of dangerous products, popularize the activities of institutions supervising the safety of toys, and contribute to the protection of children's health. The paper also outlines possible future developments in the field of prevention in the selection of imported toys.

## **2 THEORETICAL BACKGROUND**

In the beginning, it is necessary to get acquainted with the terms that will appear in the article. The basic concepts of the issue are toys, risks, health, phthalates, and counterfeiting. The toy is generally to say that the toy should stimulate the child's movement, sensory, intellectual, and emotional development. It should develop his social attitudes in a desirable direction and help to develop good habits. It should stimulate and appropriately direct his imagination. At the same time, it should be hygienically safe and, if possible, safe. She should be tasteful, charming, and handsome.

Furthermore, of course, she should endure something, because the goal of a child's unusual curiosity is to look inside and get to the bottom of things. In contrast, children's hands are

incredibly relentless. (Matějček, 2007) When searching for a definition of risk, it is a semantic problem that is not universally solvable. It depends very much on the industry, field, and issue, what is meant by this term. There are groups of technical, economic, and social definitions. (Tichý, 2006) Risk can be defined as the sum of the presented danger and the level of concern that this causes in an individual. (Papršteinová, 2014)

There are also toxic elements that affect human health, such as lead and cadmium. Phthalates are esters of phthalic acid, a group of mass-synthesized chemicals with the ability to accumulate in biological tissues. The toxicity of phthalates to humans and animals is a matter of concern. However, its exact mechanisms and levels may vary from phthalate to phthalate. About 90 percent of phthalates are used as plasticizers in polymers, mainly polyvinyl chloride (PVC). The softening of originally hard PVC phthalates increases its flexibility and improves its processability. Phthalates are not chemically bound to the PVC polymer and are slowly released during product use. The most widely used phthalate is DEHP, which is also the best researched and is considered to be the most problematic in terms of adverse health effects. Other commonly used phthalates include di (butyl) phthalate (DBP), di (ethyl) phthalate (DEP), di-isononyl phthalate (DINP), benzyl butyl phthalate (BBP), dodecyl phthalate (DIDP), di (n-octyl) - phthalate (DNOP). DEHP and DBP are classified as reprotoxic substances according to the European Union Directive 67/548 / EEC on the classification and labelling of dangerous substances. Recent research suggests reproductive toxicity in other commonly used phthalates, such as BBP and DINP. However, in the case of DINP and DIDP, their nephrotoxic effect and effect on liver function are considered to be the most serious. A correlation between the incidence of asthma and the incidence of phthalate-containing materials in households was also described. A statistically significantly higher incidence of allergies and asthma correlated with the concentration of phthalates in household dust. (Šuta, 2007)

Given that there are a significant number of products on the market that are not certified originals, we will focus on counterfeits. A counterfeit is a product, including its packaging, on which, without the trademark proprietor's consent, a sign identical or interchangeable with the trademark is affixed, infringing the rights of the trademark proprietor under a special legal regulation. Furthermore, all items bearing such a mark (brands, logos, labels, stickers, brochures, instructions for use, warranty documents, etc.), even if they are listed separately, and separate packaging on which such a mark is placed. (634/1992 Coll. Act on Consumer Protection)

Toys reported in the Safety Gate system also contained dangerous toxic elements such as lead and cadmium. These elements pose a risk not only to humans but also to the environment.

Lead can cause both acute and chronic poisoning. Acute poisonings (so-called saturnism) are rare today, rather chronic poisonings related to environmental pollution can be observed. (Rusek, 2001) The neurotoxicity of lead is considered to be the most severe and insidious. The nervous system is affected even in the case of deficient levels of lead in the blood, and chronic poisoning at such low levels may not show clinical symptoms. (Patková, 2009) Cadmium is one of the elements whose effect on the health of the human body is harmful. This may be because cadmium has similar electronegativity and similar chemical properties to the essential heavy metal zinc. The toxicity of cadmium is manifested only when it replaces zinc in vital proteins (zinc fingers). The same mechanism of uptake and transport of these two metals in the body also contributes to this. (Kenšová, 2014)

In the Czech Republic, Act 22/1997 deals with technical requirements for products and conformity assessment. It also regulates CE marking. The article does not deal with the CE marking, because the CE marking is only a technical minimum for the entry of a product into the EU market, it does not further describe the safety of the product, it is only a mark of

conformity. Nevertheless, when buying a toy, this marking must be on the packaging. However, it does not mean that the product is 100% safe.

### **3 METHODOLOGY**

Literary research was prepared based on a study of available professional literary sources. The chapter of achieved results uses the analysis of the EUIPO study and the data of toys captured on the Czech Republic territory from the Safety Gate system from March 2019 to April 2020. The results will be compared using the comparison method, and conclusions will be drawn. Furthermore, thanks to descriptive statistics, risk factors when buying toys are described. Their frequency is compared in the form of graphs.

### **4 RESULTS**

In this chapter, the achieved results will be interpreted. The whole part is divided into two subchapters. The first part concerns the comparison of counterfeit toys captured in the Czech Republic with the qualitative risk analysis of counterfeits by the EUIPO organization and the procedure of reporting products to the Safety Gate system. Following the implementation of legislative changes concerning hazardous chemicals, the EU market began to change. REACH legislation has banned certain dangerous chemicals and has also begun to address the issue of phthalic acid esters and other substances in toys.

Furthermore, legislation has been adopted directly concerning toys and the chemicals in them. The Safety Gate system can be considered as one of the most sophisticated information systems. It provides states not only with warnings about dangerous products but also with an idea of market safety. The data analysis examines the period from March 2019 to April 2020. After that, this analysis is compared with a qualitative analysis of the risks of counterfeiting by EUIPO from 2019.

The second part of graphically shows the process of selecting toys. Given that this work aims to spread awareness among consumers, it is possible to take this flowchart as a guide on how to make the right decision in the decision-making process of choosing toys.

#### **Analysis of Safety Gate system data in the period from March 2019 to April 2020**

The selected category was toys and entertainment items. The data were analysed from March 2019 to April 2020 due to the observation of the number of seizures for the last year in the Czech Republic. The DTEST database was used, as this is direct data from the Safety Gate system. A filter for the point of capture, which was the Czech Republic, and a filter for the period from March 2019 to April 2020, were used. Filters for hazards in the given period were also used. These filters were mainly chemical hazards, environmental hazards, suffocation hazards, and combined hazards. The obtained data were further processed in Microsoft Excel, and for clarity, a pie chart was used, which better visualizes the types of risks. In the analysis of counterfeit data, all reported cases were studied in more detail. The card of the reported product was examined whether the product is a counterfeit or a possible counterfeit. This card also contained information on the origin of the goods. (Ministry of Health, 2020)

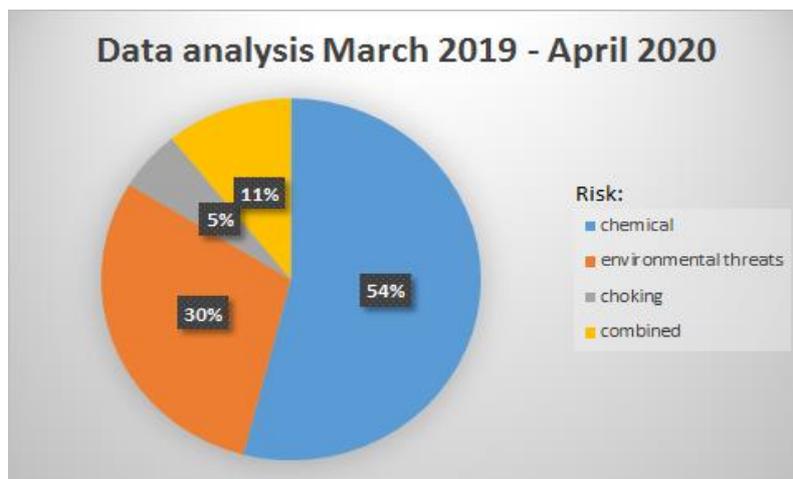


Fig. 1 – Occurrence of risks March 2019 – April 2020. Source: own research

The total number of reported risky toys was 37 pieces. Of these, 20 toys were chemically dangerous, 11 posed a threat to the environment, two toys posed a risk of suffocation, and four were dangerous in several respects. The warning from imports should be the fact that all reported dangerous toys came from China.

From a chemical point of view, phthalic acid esters, especially DEHP-bis (2-Ethylhexyl) - phthalate, were present in the toys. Furthermore, lead and cadmium, which pose a risk to both the child and the environment. The risk of suffocation was dominated by unsecured battery covers and easily detachable parts. The combined risks consisted of chemical hazards and suffocation in two cases, environmental hazards, and burns in one case and suffocation risks with health risks in one case.

### **Comparison of the risk analysis of counterfeit toys captured in the Czech Republic with the qualitative risk analysis of the EUIPO organization's false organizations.**

The comparison compares the analysis of counterfeit data from the Safety Gate system with the qualitative risk analysis of counterfeits from 2019 by EUIPO.

### **Counterfeit data analysis March 2019 - April 2020**

Analysis of counterfeit or probable counterfeit data revealed that 6 of the 37 toys reported from March 2019 to April 2020 were counterfeit or potential counterfeits. Of the total, this amount is 16.22%.

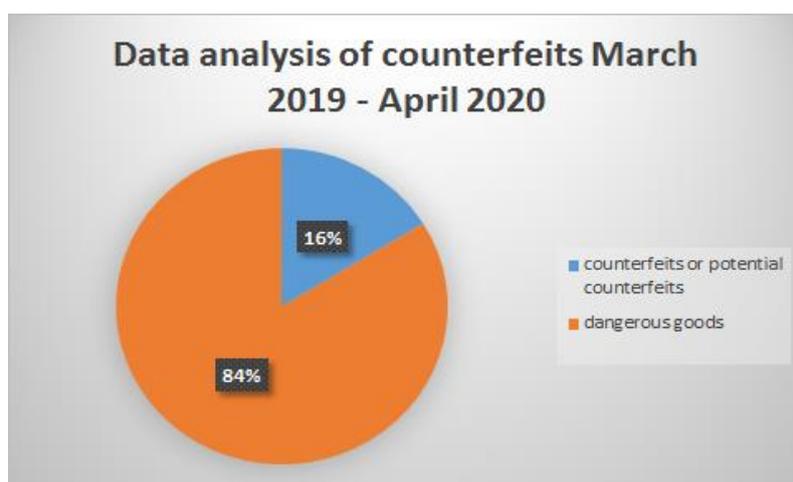


Fig. 2 – Occurrence of counterfeits. Source: own research

All counterfeits posed a chemical hazard. Their composition violated the REACH Regulation on Dangerous Chemicals. The authorization requirement under REACH does not apply to imported consumer products. Together with the restrictions, the authorization process makes up the main way in which substances can become banned or restricted by REACH. (Molander & Rudén, 2012). Dangerous DEHP phthalate was present in every counterfeit.

**Qualitative analysis of counterfeit risks by EUIPO**

Regarding the origin of the reported dangerous and counterfeit products, it was found that most came from outside the EU. However, several entries also concerned about products originating in the European single market. (EUIPO, 2019) In China, managing product quality is a complex matter because of the nature of typical Chinese supply chains. It isn't at all atypical for Chinese firms to have multiple supply chains, each of which can run two to three suppliers deep. These long and ever-changing supply chains make it especially difficult to track the origin and quality of raw materials and manufacturing processes. (Berman & Swani, 2010)

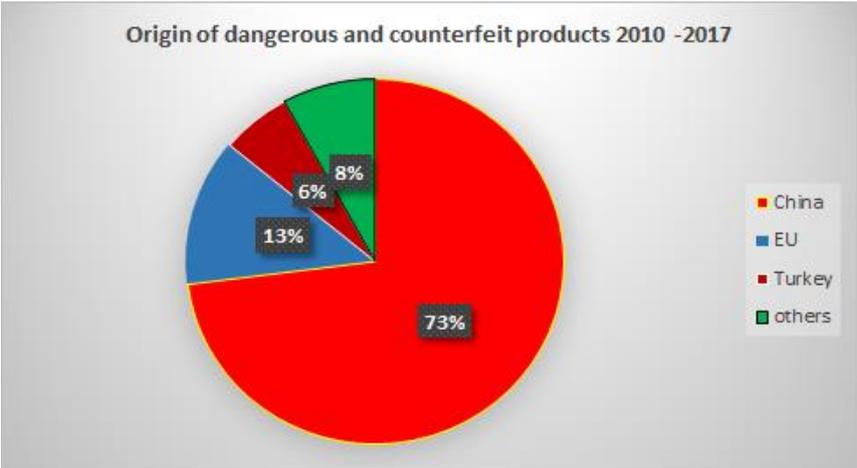


Fig. 3 – Origin of reported dangerous and counterfeit products. Source: EUIPO (2019)

When analysing the types of reported risks, it was found that many Safety Gate alerts refer to more than one type of hazard. Some risks are often perceived simultaneously and individually. A comprehensive analysis of all cases of the hazard was required. This survey of Safety Gate alerts in the years 2010 - 2017 concerned, dangerous counterfeits and led to the following statistics according to (EUIPO, 2019)

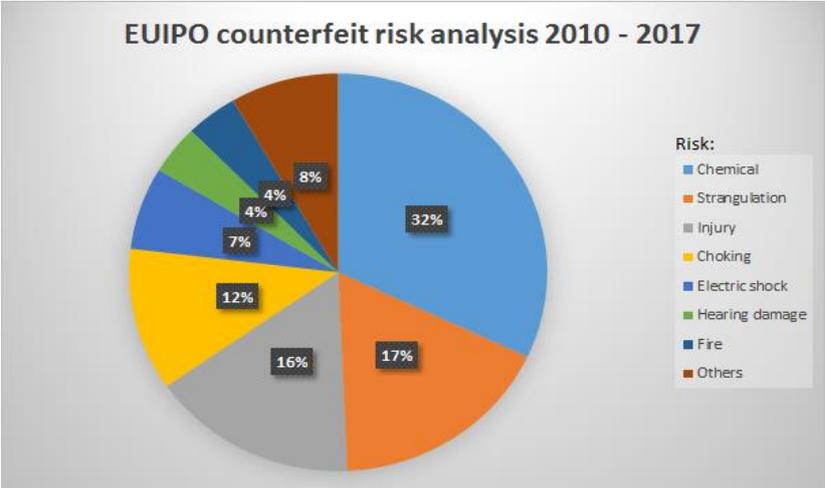


Fig. 4 – Risk analysis of dangerous counterfeits by EUIPO 2010-2017. Source: EUIPO (2019)

Toys were the most common type of product reported as dangerous and counterfeit under the Safety Gate system between 2010 and 2017. They accounted for almost 50% of alerts. Most of the dangerous products posing a chemical risk were toys. (EUIPO, 2019)

191 out of 15,459 reported products were recorded as counterfeit or potentially counterfeit between 2010 and 2017. (EUIPO, 2019)

Due to the limited information available in the records, it was not possible to verify whether the dangerous goods were, in fact, counterfeit or not. The analysis remains largely a conjecture. (EUIPO, 2019)

The above study and the conclusions drawn from it only prove that it makes sense to address the issue further.

### **Comparisons and conclusions from the analyses**

Both statistics show that hazardous chemicals in toys are the most significant risk. In the EUIPO Counterfeit Risk Analysis, only counterfeits were examined, not dangerous products, as in the data analysis from March 2019 to April 2020. In the Safety Gate March 2019 - April 2020 data analysis, there is only one risk for toy counterfeits: chemical risk. On the contrary, there are several risks in EUIPO's risk analysis. Such a fact is logical, as it is examined for a much more extended period. The risk for the environment occurs in only one of the statistics. This can be explained by a different view of the researched issues.

China dominates in the import of these products. No other country can be expected in this respect, as China is the largest importer of the Czech Republic. EUIPO's counterfeit risk analysis accounts for almost three-quarters of all dangerous counterfeits imported. However, compared to data analysis from March 2019 - April 2020, this is less. In this statistic, all dangerous counterfeit toys came from China.

### **Procedure for reporting products to the Safety Gate system**

The procedure for reporting a product to the Safety Gate system is straightforward. If the consumer finds that the product is dangerous, he can submit a complaint to the Czech Trade Inspection Authority (for non-food products) through the DTEST website. After redirecting to the site, you can find a link to report the product. Then it is necessary to write a fundamental characteristic of the product. (a) Product - for this item, it is mandatory to fill in the type of product, brand, and model/type, it is recommended to include a barcode and photos of the product. (b) Manufacturer/importer - in this field, the name of the manufacturer or importer must be filled in. It is advisable to add other contact details. (c) Seller - if the seller is someone other than the manufacturer or importer himself, it is the shipper's responsibility to state his name. It is also advisable to fill in, as in the previous case, other contact details. The sender can also fill in the date of purchase of the reported product and upload a photo of the receipt. (d) Risk - the penultimate item is a risk. The sender fills in here what risk has been identified. It can also further fill in the circumstances of the accident if it happened and upload photos. (e) Sender - the last item is the sender himself. The sender must fill in his name or may add other contact details.

After examining the Czech Trade Inspection Authority's initiative, the product is reported to the Safety Gate system upon confirmation of the danger. It should be withdrawn from the entire EU market. The European Commission reports on dangerous products every week. These reports are publicly available on the European Commission's Safety Gate website.

The process of selecting toys

The flowchart shows a visualization of responsible consumer behaviour when choosing toys. The process and decision blocks were selected so that the risk could be controlled directly in the store. The threats were further chosen, taking into account EUIPO's risk analysis.

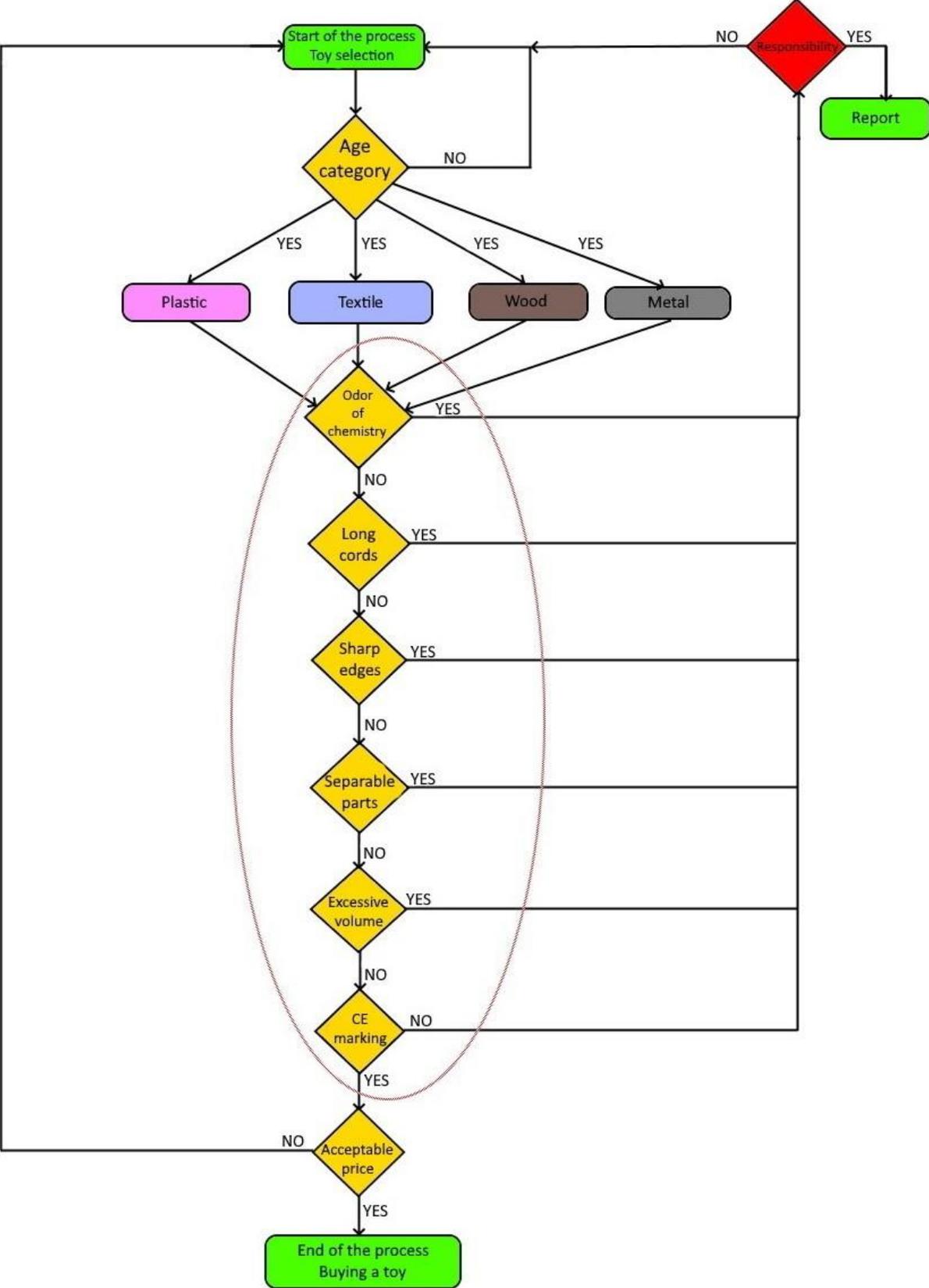


Fig. 5 – Flow chart of the toy selection process. Source: own research

The most important part of the process, which consumers often overlook, is highlighted in red.

## 5 DISCUSSION

The paper dealt with current knowledge in the field of health risks of buying imported toys. The benefit can be seen in the fact that it acquaints the general public with the issue of risks in selecting toys and proposes measures to minimize these risks. Statistics allow the public to get an overall idea of the hazardous goods when buying and thus help them prevent the purchase of goods that could harm them in any way. In order to eliminate threats, the first step should be society-wide enlightenment. Consumers often have no idea that they may come across a dangerous product that could cause them health complications. This awareness could be spread in the form of short videos during television broadcasts. The broadcast could be followed by a short consumer guide to the world of toys.

Another rather economic step would be to impose customs duties on all toys imported from China. The imposition of a duty would affect those consumers who choose toys primarily based on price, as the price of these toys would increase. Equally crucial in such a case would be the domestic toy industry's support, which would be supported by such a measure.

The last step must be to make the consumer aware of the potential risk, take an active interest in product safety, avoid risky e-shops and markets, and pay attention to the risk factors that can occur with toys.

## 6 CONCLUSION

The presented paper brought current knowledge in the field of health risks of purchasing imported toys. The paper analysed, described, and reflected on the current situation in anti-counterfeiting and consumer protection. In a way, it has created a kind of non-existent statistic between international trade and dangerous toy counterfeits. As no such statistics are reported regularly, the main benefit of the work is to alert consumers to the possible risks they may face when buying toys. Unfortunately, consumer protection authorities and institutions are never able to capture all goods that infringe intellectual property rights or are risky for consumers. It acquaints the general public with the procedure of reporting the product to the supervisory authorities and acquaints with the process of selecting toys.

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# WATER FOOTPRINT AND THE REVISITED COMPETITIVENESS PERSPECTIVE OF THE CZECH REPUBLIC AND THE SLOVAK REPUBLIC IN TERMS OF BILATERAL TRADE

*Andrea Nagyová, Denisa Čiderová*

## **Abstract**

In the view of Mahbubani, the concept of competition founded on a positive-sum game allowing economies to grow together is the matter of evolution from the zero-sum-game rivalry. In our methodology, resting on the basics of natural and acquired advantages driving international trade for centuries, we apply the “2 by 2 by 1” model and terminology inspired by Krugman. Comparison of selected commodities over the years 2012-2018, *ceteris paribus*, enables data coverage in the case of the Czech Republic and the Slovak Republic in the period before the outbreak of the COVID-19 pandemic and a consistent interpretation. The aim of our paper was to provide an alternative view of competitiveness on the basis of water footprint introduced as a concept in the early 2000s and evolving ever since. Our results speak in favour of a revisited (water-footprint) perspective of competitiveness in the twenty-first century in the case of the Czech Republic and the Slovak Republic, namely through Czech exports of pork to the Slovak Republic and Slovakian exports of beef to the Czech Republic in bilateral trade.

**Keywords:** *water footprint, Czech Republic, Slovak Republic, competitiveness, trade, absolute advantage, comparative advantage*

## **1 INTRODUCTION**

*“Although comparative advantage is a simple concept, experience shows that it is a surprisingly hard concept for many people to understand (or accept). Indeed, the late Paul Samuelson – the Nobel laureate economist who did much to develop the models of international trade [...] – once described comparative advantage as the best example he knows of an economic principle that is undeniably true yet not obvious to intelligent people.”* (Krugman, Obstfeld, & Melitz, 2018)

Awareness of natural and acquired advantages has been the driving force of overseas trade facilitated by European merchant ships: in 1470 dominated by the Netherlands with freight capacity 60 000 t of merchandise, but outnumbered by Great Britain with 1 000 000 t of freight capacity by 1780 (Krpec & Hodulák, 2012). With international trade being one of the first topics addressed by economists in the late 18th century, it is late 18th century that marks the classical political economy challenging the mercantilist doctrine [NB According to Krpec & Hodulák (2012), the 1703 preferential agreement facilitating exchange of English cloth for Portuguese wine inspired the Ricardian concept of comparative advantage].

Natural and acquired advantages of countries have not just been observed, but also formulated for not less than a quarter of a century (Smith, 1776): “The natural advantages which one country has over another in producing particular commodities are sometimes so great, that it is acknowledged by all the world to be in vain to struggle with them. [...] Whether the advantages which one country has over another, be natural or acquired, is in this respect of no consequence. As long as the one country has those advantages, and the other wants them, it will always be more advantageous for the latter, rather to buy of the former than to make. It is an acquired advantage only, which one artificer has over his neighbour, who exercises another trade; and

yet they both find it more advantageous to buy of one another, than to make what does not belong to their particular trades.”

The argument that two countries can compensate their individual lower efficiency and mutually benefit from bilateral trade has been in the centre of traditional discourse on competitiveness. A (mercantilist) monetary perspective of export earnings reinforced by the prospect of economies of scale may, however, clash with non-financial aspects such as the water footprint, which is in our focus. In 2017 a team of authors (Liu et al., 2017) concluded that addressing water scarcity requires “concerted efforts of hydrologists, economists, social scientists, and environmental scientists to develop integrated approaches to capture the multi-faceted nature of water scarcity”. Furthermore, Rosa et al. (2019) emphasise in their paper titled *Global unsustainable virtual water flows in agricultural trade* that “globalisation of water through trade contributes to running rivers dry, an environmental externality commonly overlooked by trade policies”. Moreover, in an upcoming paper Muratoglu (2020) points out that despite “its high contribution to global wheat production, increasing population and strong wheat-based diet, quantitative, comparative and up-to-date analyses of the blue and green WF [water footprint] and the VW [virtual water] of wheat production in Turkey are not available”, and, subsequently, the respective paper strives to contribute to the “national and international water management and planning studies to increase the water allocation efficiency of agricultural products”.

Our paper is structured into Part 2 Theoretical background, where we draw on Adam Smith’s masterpiece *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776) with terminology of the associated Ricardian model inspired by Krugman, Obstfeld and Melitz (2018); and Part 3 Methodology, in which we apply the water footprint to the Ricardian model. Part 4 Results presents data for the 2012-2018 total trade, trade balance and total water footprint balance for selected commodities before they are interpreted in terms of revisited competitiveness in Parts 5 Discussion and 6 Conclusion.

## 2 THEORETICAL BACKGROUND

*“The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always, either in the immediate produce of that labour, or in what is purchased with that produce from other nations.”* (Smith, 1776). According to Smith (1776), labour was “the first price, the original purchase-money that was paid for all things”; yet, although labour is “the real measure of the exchangeable value of all commodities, it is not that by which their value is commonly estimated”. This is because it may be difficult to ascertain the proportion between two different quantities of labour, Smith claims, with division of labour seen as specifically challenging in agriculture. As commodities tend to be compared with other commodities rather than with labour, “[t]he greater part of people to understand better what is meant by a quantity of a particular commodity, than by a quantity of labour”.

In our further considerations we apply the “2 by 2 by 1” (two countries, two goods, one factor of production) model and terminology inspired by Krugman, Obstfeld and Melitz (2018), where:

$a_L$  = Home economy unit labour requirements

$a^*_L$  = Foreign economy unit labour requirements

Unit labour requirements mirror the inverse of productivity:  $1/a_L$  (Home economy) &  $1/a^*_L$  (Foreign economy).

As introduced in Smith's quote (1776) above, labour (L) symbolises one factor of production:

$L$  = Home economy total labour supply

$L^*$  = Foreign economy total labour supply

In the classical tradition cloth and wine are the corresponding two goods:

$a_{LC}$  = Home economy unit labour requirements in cloth production

$a_{LW}$  = Home economy unit labour requirements in wine production

$a_{LC}Q_C$  = labour used in the Home economy in producing (certain quantity of) cloth

$a_{LW}Q_W$  = labour used in the Home economy in producing (certain quantity of) wine

$$a_{LC}Q_C + a_{LW}Q_W \leq L \quad (1)$$

$a^*_{LC}$  = Foreign economy unit labour requirements in cloth production

$a^*_{LW}$  = Foreign economy unit labour requirements in wine production

$a^*_{LC}Q_C$  = labour used in the Foreign economy in producing (certain quantity of) cloth

$a^*_{LW}Q_W$  = labour used in the Foreign economy in producing (certain quantity of) wine

$$a^*_{LC}Q_C + a^*_{LW}Q_W \leq L^* \quad (2)$$

Home economy (or Foreign economy, respectively) can produce the maximum amount of either good, or a mix of both goods within the limits of its production possibility frontier:

$L/a_{LC} (L^*/a^*_{LC})$  = volume of cloth production

$L/a_{LW} (L^*/a^*_{LW})$  = volume of wine production

Along the lines of Smith's theory of absolute advantage a country may decide to participate in the international division of labour through:

$L/a_{LC}$  yards of cloth if the Home economy streamlines its labour supply into cloth production and cloth export specialisation (based on existing absolute advantage in the Home economy) together with wine import specialisation (based on existing absolute disadvantage in the Home economy).

$L^*/a^*_{LW}$  gallons of wine if the Foreign economy streamlines its labour supply into wine production and wine export specialisation (based on existing absolute advantage in the Foreign economy) together with cloth import specialisation (based on existing absolute disadvantage in the Foreign economy).

The production possibility frontier demonstrates various mixes of both goods that the Home economy or the Foreign economy can produce, and with only one factor of production:

$a_{LC}/a_{LW}$  as the Home economy *opportunity cost* of cloth (in yards) in terms of wine (in gallons) is constant

$a_{LW}/a_{LC}$  as the Home economy *opportunity cost* of wine (in gallons) in terms of cloth (in yards) is constant

$a^*_{LC}/a^*_{LW}$  as the Foreign economy *opportunity cost* of cloth (in yards) in terms of wine (in gallons) is constant

$a^*_{LW}/a^*_{LC}$  as the Foreign economy *opportunity cost* of wine (in gallons) in terms of cloth (in yards) is constant

In the Ricardian model two countries are represented by England ( $a_L$ ) and Portugal ( $a^*L$ ), cloth and wine exemplify two goods:

$a_{LC}$  = England's unit labour requirements in cloth production

$a_{LW}$  = England's unit labour requirements in wine production

$a^*_{LC}$  = Portugal's unit labour requirements in cloth production

$a^*_{LW}$  = Portugal's unit labour requirements in wine production

D. Ricardo's theory of comparative advantage assumes bilateral trade even in the case when, ceteris paribus, one yard of cloth is manufactured with 100 units of labour (England) or with 90 units of labour (Portugal), and one gallon of wine is produced, ceteris paribus, with 120 units of labour (England) or with 80 units of labour (Portugal). In terms of Smith's theory of absolute advantage it may seem that such unit labour requirements would not motivate Portugal to engage in foreign trade exchange with England, and, in the absence of international trade countries would indeed produce both goods for themselves, as Krugman, Obstfeld and Melitz (2018) point out [NB the natural advantage (such as in the case of Portugal's wine production) & the acquired advantage (such as in the case of England's cloth production) were illustrated using the example of flowers (Colombia) & computers (USA)].

Instead of producing both goods ( $a^*_{LW} + a^*_{LC}$ ), Portugal's specialisation on wine production ( $2 \times a^*_{LW}$ ) would result in savings of 10 units of labour; England's specialisation on cloth production ( $2 \times a_{LC}$ ) would double England's savings in comparison with Portugal (Tab. 1).

Tab. 1 – Comparative labour costs and advantages (England and Portugal, commodities: wine (LW) & cloth (LC)). Source: based on Filip (2005) and Krugman, Obstfeld & Melitz (2018)

	$a_{LW}$	$a_{LC}$	$a_{LW} + a_{LC}$	$2 \times a_{LW}$	$2 \times a_{LC}$	$(a_{LW} + a_{LC}) - (2 \times a_{LC})$
England	120	100	220	-	200	+20
	$a^*_{LW}$	$a^*_{LC}$	$a^*_{LW} + a^*_{LC}$	$2 \times a^*_{LW}$	$2 \times a^*_{LC}$	$(a^*_{LW} + a^*_{LC}) - (2 \times a^*_{LW})$
Portugal	80	90	170	160	-	+10

As a matter of fact, despite asymmetrical benefits both countries may be motivated to engage in bilateral trade:

$a_{LC}/a^*_{LC}$  = Home economy's relative productivity in producing cloth

$a^*_{LC}/a_{LC}$  = Foreign economy's relative productivity in producing cloth

$a_{LW}/a^*_{LW}$  = Home economy's relative productivity in producing wine

$a^*_{LW}/a_{LW}$  = Foreign economy's relative productivity in producing wine

Tab. 2 – Relative productivity (England and Portugal, commodities: wine (LW) & cloth (LC)). Source: based on Filip (2005) and Krugman, Obstfeld & Melitz (2018)

	$a_{LW}/a^*_{LW}$		$a_{LC}/a^*_{LC}$	
England	12/8	150%	10/9	<b>111%</b>
	$a^*_{LW}/a_{LW}$		$a^*_{LC}/a_{LC}$	
Portugal	8/12	<b>67%</b>	9/10	90%

Portugal's relative productivity in producing wine (Tab. 2) favours Portugal's wine export specialisation and cloth import specialisation, while England's wine import specialisation combined with cloth export specialisation in terms of England's relative productivity in producing cloth would be complementary ( $a_{LC}/a^*_{LC} < a_{LW}/a^*_{LW}$ ).

The principle of absolute advantage and the principle of comparative advantage operate in the classical model of international trade (Krugman, Obstfeld & Melitz, 2018; Staněk et al., 2018; Baláž et al., 2019) characterised by (a) "2 by 2": two countries, two goods; (b) indifferent

product; (c) inventions are disregarded; (d) simple labour theory of value; (e) inland production factor mobility; (f) zero transaction costs; (g) perfect competition; and (h) free trade.

In the following part, we focus on the methodology applied in our paper.

### 3 METHODOLOGY

The aim of our paper was to provide an alternative view of competitiveness on the basis of water footprint introduced as a concept in the early 2000s (Hoekstra, 2003) and evolving ever since (Chapagain & Hoekstra, 2004; Chapagain, Hoekstra, & Savenije, 2006; Chapagain & Hoekstra, 2008; Hoekstra & Chapagain, 2007; Hoekstra & Chapagain, 2008).

Smith's "static" concept (1776) introduced in Part 2 Theoretical background of this paper was further shaped by considering alternative ways of land allocation – with preference given to the production of corn or cattle.

Historically, the cost of corn comprised of: the landlord's rent; the labourers' income; maintenance of the labouring cattle employed in producing corn; the farmer's profit as well as stock replacement.

Unlike cattle, hog was cheap to maintain, which – *ceteris paribus* supply equals demand – ultimately led to a much lower price of butcher's-meat pork. As soon as the demand for pork exceeded its supply and necessitated increased expenses to grow food for feeding and fattening of hogs, price of butcher's-meat pork would rise towards price levels of cattle [NB Moreover, contemporary large-scale agricultural production of hog and cattle necessitates a large volume of drinking water (Staněk, Doliak, & Ivanová, 2017)].

Therefore, Smith (1776) identified three sorts of the so-called rude produce in his classification: 1. produce where "it is scarce in the power of human industry to multiply at all"; 2. produce that can be multiplied "in proportion to the demand"; and 3. produce in which "the efficacy of industry is either limited or uncertain."

This brings us to an analogy of the total labour supply ( $L$  or  $L^*$ ) in a country: "The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always, either in the immediate produce of that labour, or in what is purchased with that produce from other nations." (Smith, 1776)

when adapted to the case of water: "The annual water supply [in terms of water availability] of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always, either in the immediate produce of that water supply, or in what is purchased with that produce from other nations." (Smith, 1776)

In our reflection, we consider the classical model of comparative advantage [NB "model in which only two goods are produced and consumed. This simplified analysis allows us to capture many essential points about comparative advantage and trade" (Krugman, Obstfeld & Melitz, 2018)] and abstract from a multigood model, while being aware that any country consumes and is in the position to produce  $N$  as a large number of different goods with  $aL1 < \dots < aLN$  unit labour requirements. Aiming to provide an alternative view of competitiveness on the basis of water footprint with data for selected commodities from national water footprint accounts in our paper, alternatively to the concept of labour productivity in the Ricardian model we deliberate to apply average water footprint (Tab. 3) as a source of absolute/comparative advantage (Tab. 4).

Tab. 3 – Average water footprint (l/kg) in the Czech Republic and the Slovak Republic for selected commodities.

Source: own research

Commodity	Average water footprint, l/kg	
	$a^*_{WF}$	$a_{WF}$
Wheat	945	1 097
Barley	799	1 083
Maize	645	932
Rice, paddy	2 533	1 944
Soyabeans	2 270	2 242
Beef	11 114	8 927
Pork	4 236	4 290
Sheep (mutton+goat)	7 070	6 421
Sugar beet	103	113
Sugar cane	201	209

Water footprint ( $WF$  or  $WF^*$ ) may be defined as the volume of water consumed in the production of goods or services (Water Footprint Network). In a group of selected commodities (including corn and cattle specified by Smith, 1776) water footprint ranges from 103 l/kg (sugar beet) to 11 114 l/kg (beef) in the Czech Republic ( $a^*_{WF}$ ) and from 113 l/kg (sugar beet) to 8 927 l/kg (beef) in the Slovak Republic ( $a_{WF}$ ).

As defined before, comparative advantage symbolises the relatively biggest absolute advantage when a country has an absolute advantage in production of both goods, or vice versa, as the relatively lowest absolute disadvantage if a country has absolute disadvantage in production of both goods. From the group of selected commodities (including corn and cattle specified by Smith, 1776) it is the case of cattle where we will consider absolute/comparative advantage.

Tab. 4 – Absolute/comparative advantages (the Czech Republic and the Slovak Republic, commodities: beef & pork; pork & sheep (mutton+goat); beef & sheep (mutton+goat)). Source: own research

<b>Absolute</b> advantages, commodities: beef (WFB) & pork (WFP)		
Average water footprint, l/kg		
	$a^*_{WFB}$	$a^*_{WFP}$
Czech Republic	11 114	<b>4 236</b>
	$a_{WFB}$	$a_{WFP}$
Slovak Republic	<b>8 927</b>	4 290
<b>Absolute</b> advantages, commodities: pork (WFP) & sheep (WFS)		
Average water footprint, l/kg		
	$a^*_{WFP}$	$a^*_{WFS}$
Czech Republic	<b>4 236</b>	7 070
	$a_{WFP}$	$a_{WFS}$
Slovak Republic	4 290	<b>6 421</b>
<b>Comparative</b> advantages, commodities: beef (WFB) & sheep (WFS)		
Average water footprint, l/kg		
	$a^*_{WFB}$	$a^*_{WFS}$
Czech Republic	11 114	7 070
	$a_{WFB}$	$a_{WFS}$
Slovak Republic	<b>8 927</b>	<b>6 421</b>
<b>Comparative</b> advantages in bilateral trade, commodities: beef (WFB) & sheep (WFS)		
Average water footprint, l/kg		
	$a^*_{WFB}/a_{WFB}$	$a^*_{WFS}/a_{WFS}$
Czech Republic	11 114/ <b>8 927</b>	7 070/ <b>6 421</b>
	$a_{WFB}/a^*_{WFB}$	$a_{WFS}/a^*_{WFS}$
Slovak Republic	<b>8 927/11 114</b>	<b>6 421/7 070</b>

In a comparative perspective (Tab. 4) of beef (WFB), pork (WFP) and sheep (WFS) the Czech Republic has an absolute advantage in pork production ( $a^*WFP$ ), and the Slovak Republic has an absolute advantage in beef ( $aWFB$ ) & sheep ( $aWFS$ ) production. In the absence of international trade the Czech Republic and the Slovak Republic would each produce the respective commodities to meet demand in their own economy. And although primary (absolute advantage) consideration of bilateral trade would, ceteris paribus, suggest pork export specialisation in the Czech Republic and beef or sheep export specialisation in the Slovak Republic, secondary (comparative advantage) consideration would, ceteris paribus, admit sheep export specialisation of the Czech Republic and beef export specialisation of the Slovak Republic in bilateral trade ( $a^*_{WFS}/a_{WFS} < a^*_{WFB}/a_{WFB}$ ). We should keep in mind that individual exporters or importers have their own motivation for exports or imports, which result in the aggregate exports and aggregate imports of a country analysed in the following part.

## 4 RESULTS

Our analysis of foreign trade developments in the Czech Republic and the Slovak Republic (based on 2012 – 2018 data from the ITC TradeMap Database) will start with total trade and trade balance (Tab. 5). This will be followed by total trade and trade balance specifically in the case of selected commodities (Tab. 6 and 7) identified earlier. We will then pay attention to total water footprint balance (Tab. 8 and 9).

Tab. 5 – Foreign trade (goods; the Czech Republic, the Slovak Republic, bilateral trade) between 2012 and 2018 (export, import, balance, sum; in thousand €). Source: ITC TradeMap Database (2020)

	2012	2013	2014	2015	2016	2017	2018
<b>Czech Republic</b>							
Export (EX)	121 627 165	121 606 277	131 111 401	141 617 025	146 456 172	161 309 678	171 486 559
Import (IM)	108 645 182	107 303 042	115 272 367	126 771 963	128 602 053	144 196 773	156 585 707
Balance (EX-IM)	12 981 983	14 303 235	15 839 034	14 845 062	17 854 119	17 112 905	14 900 852
Sum (EX+IM)	230 272 347	228 909 319	246 383 768	268 388 988	275 058 225	305 506 451	328 072 266
	2012	2013	2014	2015	2016	2017	2018
<b>Slovak Republic</b>							
Export (EX)	62 100 920	64 132 380	65 061 381	67 822 653	70 061 197	74 699 177	79 844 424
Import (IM)	59 762 314	61 204 442	61 669 775	66 144 910	68 208 093	73 657 636	79 752 722
Balance (EX-IM)	2 338 606	2 927 938	3 391 606	1 677 743	1 853 104	1 041 541	91 702
Sum (EX+IM)	121 863 234	125 336 822	126 731 156	133 967 563	138 269 290	148 356 813	159 597 146
	2012	2013	2014	2015	2016	2017	2018
<b>Bilateral trade: the Czech Republic and the Slovak Republic</b>							
CZ export to SK (EX)	11 023 706	10 769 064	11 014 347	12 744 044	12 246 926	12 322 612	12 942 307
CZ import to SK (IM)	6 620 293	6 156 059	6 109 984	6 511 356	6 553 188	6 964 744	7 768 421
Balance (EX-IM)	4 403 413	4 613 005	4 904 363	6 232 688	5 693 738	5 357 868	5 173 886
Sum (EX+IM)	17 643 999	16 925 123	17 124 331	19 255 400	18 800 114	19 287 356	20 710 728

Total trade (EX+IM) of the Czech Republic intensified from 230 bn € (in 2012) to 328 bn € (in 2018). In the same period, total trade (EX+IM) of the Slovak Republic rose, too, but growth of total trade in the Czech Republic (43%) outnumbered the one in the Slovak Republic (31%). Foreign trade balance (EX-IM) of the Czech Republic has been more or less stable while the same indicator (EX-IM) dropped significantly in the Slovak Republic (Tab. 5). In a mercantilist perspective, a diminishing positive foreign trade balance of the Slovak Republic might be of concern. Still, the ratio of the balance (EX-IM) and total trade (EX+IM) in bilateral trade of the Czech Republic and the Slovak Republic remained constant at 25% (in 2012 and 2018). Now the aggregate data will be complemented with data on selected commodities (Tab. 6).

Tab. 6 – Foreign trade balance (selected commodities; the Czech Republic and the Slovak Republic) between 2012 and 2018 (in thousand €). Source: ITC TradeMap Database (2020)

Czech Republic	Balance in 2012	Balance in 2013	Balance in 2014	Balance in 2015	Balance in 2016	Balance in 2017	Balance in 2018
Commodity							
Wheat	97 563	107 974	159 270	192 377	186 184	150 179	125 445
Barley	75 169	41 774	29 943	79 508	67 121	71 413	46 207
Maize	71 638	47 347	27 917	12 403	17 299	25 890	6 447
Rice, paddy	-68	-489	-351	-744	-468	-326	-262
Soyabbeans	-8 609	-15 338	-13 367	-9 445	-18 394	-2 727	-6 208
Beef	-7 903	-8 076	-8 473	-11 082	-10 405	-12 734	-11 314
Pork	-426 526	-423 941	-427 407	-438 446	-455 225	-523 511	-511 683
Sheep (mutton+goat)	-2 337	-2 128	-2 214	-2 587	-2 165	-1 702	-2 235
Sugar beet	-1 107	16 266	-1 025	-1 954	-1 277	-4 827	-4 207
Sugar cane	-1 825	-2 661	-2 949	-2 519	-2 491	-5 470	-8 170
Total trade balance for selected commodities	<b>-204 005</b>	<b>-239 272</b>	<b>-238 656</b>	<b>-182 489</b>	<b>-219 821</b>	<b>-303 815</b>	<b>-365 980</b>
Slovak Republic	Balance in 2012	Balance in 2013	Balance in 2014	Balance in 2015	Balance in 2016	Balance in 2017	Balance in 2018
Commodity							
Wheat	23 565	52 448	56 151	88 667	94 975	83 026	75 515
Barley	13 187	-6 363	9 213	22 161	22 177	7 623	2 276
Maize	66 265	48 749	47 875	48 680	30 405	61 803	27 807
Rice, paddy	141	-181	-313	-377	-495	-246	-303
Soyabbeans	8 283	16 925	6 735	15 830	16 532	18 383	13 503
Beef	-15 275	-22 011	-13 748	-29 508	-35 711	-47 188	-49 948
Pork	-157 898	-178 996	-163 809	-162 375	-229 020	-264 906	-244 042
Sheep (mutton+goat)	2 352	2 012	3 167	2 386	1 990	2 289	2 525
Sugar beet	87 040	6 050	-1 566	-666	-1 650	-1 403	-1 690
Sugar cane	-306	-257	-1 152	-1 892	-1 929	-1 654	-1 703
Total trade balance for selected commodities	<b>27 354</b>	<b>-81 624</b>	<b>-57 447</b>	<b>-17 094</b>	<b>-102 726</b>	<b>-142 273</b>	<b>-176 047</b>

In the Czech Republic the negative total trade balance for selected commodities intensified and the initially positive figures in the case of the Slovak Republic (2012) fell sharply, too. Both the Czech Republic and the Slovak Republic registered export earnings (2012-2018) from wheat and maize in contrast with beef and pork. Both beef and pork correspond with commodities analysed in Part 3 Methodology, so the bilateral trade balance will be of our interest in Tab. 7.

Tab. 7 – Bilateral trade balance (selected commodities; the Czech Republic and the Slovak Republic) between 2012 and 2018 (in thousand €). Source: ITC TradeMap Database (2020)

Bilateral trade balance: Czech Republic & Slovak Republic	Balance in 2012	Balance in 2013	Balance in 2014	Balance in 2015	Balance in 2016	Balance in 2017	Balance in 2018
Commodity							
Wheat	-187	46	847	487	-400	367	-1 801
Barley	8 594	8 510	4 256	7 146	3 777	10 636	10 730
Maize	3 866	3 339	-3 561	-7 057	-5 434	-7 232	-6 120
Rice, paddy	9	-85	-143	-247	-240	-125	-95
Soyabbeans	328	-17	-22	620	1 046	642	37
Beef	11 922	10 901	12 788	16 923	18 137	19 350	22 341
Pork	85 459	80 687	72 681	48 971	46 944	47 759	42 724
Sheep (mutton+goat)	278	355	339	373	464	623	415
Sugar beet	-3 577	24 897	3 423	52	-703	171	-300
Sugar cane	309	677	650	758	1 235	1 207	1 010
Total trade balance for selected commodities	<b>107 001</b>	<b>129 312</b>	<b>91 257</b>	<b>68 026</b>	<b>64 827</b>	<b>73 399</b>	<b>68 941</b>

Over the same period (2012-2018), beef and pork played the central role in bilateral trade balance of the Czech Republic and the Slovak Republic among selected commodities. On the one hand, bilateral trade balance of the Czech Republic and the Slovak Republic doubled (from 12 mil. € in 2012 to 22 mil. € in 2018) in the case of beef; on the other hand, in the case of pork bilateral trade balance of the Czech Republic and the Slovak Republic halved (from 85 mil. € in 2012 to 43 mil. € in 2018). A (mercantilist) monetary perspective usually determining existence or lack of competitiveness will be complemented in Tab. 8 with the water footprint point of view.

Tab. 8 – Total water footprint balance in the Czech Republic and the Slovak Republic for selected commodities internationally traded between 2012 and 2018 (in thousand m<sup>3</sup>/t). Source: ITC TradeMap Database (2020)

Czech Republic	Water footprint in 2012	Water footprint in 2013	Water footprint in 2014	Water footprint in 2015	Water footprint in 2016	Water footprint in 2017	Water footprint in 2018
Commodity							
Wheat	1 651 608	1 646 480	2 591 128	2 204 825	2 628 967	2 663 799	1 922 985
Barley	496 149	297 613	226 153	696 103	628 559	671 649	512 644
Maize	496 274	302 994	275 132	170 744	207 358	293 428	69 749
Rice, paddy	-54	-1 265	-823	-1 531	-1 119	-751	-490
Soyabeans	-52 001	-75 470	-72 338	-54 401	-112 269	-17 003	-32 098
Beef	-158 250	-192 025	-239 965	-230 362	-310 134	-400 513	-394 146
Pork	-1 123 930	-1 118 762	-1 222 618	-1 348 875	-1 346 659	-1 446 665	-1 498 251
Sheep (mutton+goat)	-3 405	-3 269	-3 103	-3 249	-3 103	-1 885	-2 686
Sugar beet	-211	2 913	-439	-528	-286	-15 588	-1 429
Sugar cane	-424	-609	-815	-789	-942	502	-2 932
Total water footprint balance for selected commodities	<b>1 305 756</b>	<b>858 601</b>	<b>1 552 313</b>	<b>1 431 938</b>	<b>1 690 371</b>	<b>1 746 972</b>	<b>573 346</b>
Slovak Republic	Water footprint in 2012	Water footprint in 2013	Water footprint in 2014	Water footprint in 2015	Water footprint in 2016	Water footprint in 2017	Water footprint in 2018
Commodity							
Wheat	198 003	479 078	552 123	812 756	1 071 932	860 512	715 979
Barley	90 968	-30 802	98 058	217 967	217 510	90 590	35 074
Maize	325 613	284 049	373 809	435 923	253 990	524 732	197 276
Rice, paddy	1 496	-97	-497	-800	-1 171	-410	-542
Soyabeans	29 084	77 799	23 157	74 989	92 452	106 285	88 942
Beef	-62 754	-106 718	-49 898	-90 949	-114 688	-147 707	20 040
Pork	-335 364	-545 639	-453 753	-506 926	-683 632	-702 973	-676 273
Sheep (mutton+goat)	5 445	-1 041	7 663	4 675	4 800	6 112	7 476
Sugar beet	11 981	3 138	349	37	-348	-410	-489
Sugar cane	-49	-76	-269	-398	-397	-408	-442
Total water footprint balance for selected commodities	<b>264 423</b>	<b>159 690</b>	<b>550 741</b>	<b>947 273</b>	<b>840 448</b>	<b>736 322</b>	<b>387 041</b>

Overall total water footprint balance both in the Czech Republic and the Slovak Republic demonstrates continuous “existence” of a trade-driven water footprint (wheat, maize) as well as continuous “non-existence” of a trade-driven water footprint (pork) between 2012-2018. Both countries registered ups and downs in the total water footprint balance for selected commodities, so the balance resulting from their bilateral trade will be of particular relevance to Part 3 Methodology.

Tab. 9 – Total water footprint balance in bilateral trade (selected commodities) of the Czech Republic and the Slovak Republic between 2012 and 2018 (in thousand m<sup>3</sup>/t). Source: ITC TradeMap Database (2020)

Water footprint balance in bilateral trade: Czech Republic & Slovak Republic	Water footprint in 2012	Water footprint in 2013	Water footprint in 2014	Water footprint in 2015	Water footprint in 2016	Water footprint in 2017	Water footprint in 2018
Commodity							
Wheat	4 931	338	8 360	5 324	-8 501	-2 731	-18 560
Barley	52 439	52 006	22 782	51 631	28 692	79 129	70 804
Maize	26 268	12 449	-47 374	-63 315	-42 051	-58 416	-47 464
Rice, paddy	5	-209	-368	-515	-534	-284	-219
Soyabeans	1 939	-172	-995	3 417	5 562	3 700	212
Beef	36 349	31 909	26 098	38 137	37 304	37 119	47 185
Pork	214 526	194 778	179 562	138 227	126 431	119 053	109 006
Sheep (mutton+goat)	302	448	458	427	625	802	500
Sugar beet	-648	4 515	701	-55	-123	54	-104
Sugar cane	5	-14	-18	0	14	36	121
Total water footprint balance for selected commodities	<b>336 116</b>	<b>296 047</b>	<b>189 206</b>	<b>173 277</b>	<b>147 419</b>	<b>178 461</b>	<b>161 482</b>

In bilateral trade of the Czech Republic and the Slovak Republic (Tab. 9) the total water footprint balance for selected commodities reduced to half by 2018 from its original level in 2012. Among the selected commodities the biggest item in terms of the total water footprint balance continued to be pork, which halved between 2012 and 2018, too.

## 5 DISCUSSION

Haggarty (1976) described Adam Smith's writing as "blessedly free of that use of jargon (and [NB italics used in authentic text] mathematics) that characterizes most of the modern materials in economics. His ideas are expressed in a lucid, straightforward manner that makes them accessible to all." Throughout the years, the static nature of the classical tradition was dynamized, particularly by the so-called new trade theory. Krugman, Obstfeld and Melitz (2018) identified several misconceptions about comparative advantage, pointing out that "trade is beneficial even if a country's exports embody more labour than its imports" and the simple one-factor model is a good way to deal with them. Henceforth, international trade may not necessarily put the Home economy at risk.

It goes without saying that we should consider distance and borders between the Home economy and the Foreign economy, trade barriers as well as controversies in trade policy, environmental issues (e.g. water footprint) or cultural trends (vegetarian/vegan lifestyle), too. Neither should we ignore the role that international trade plays in the Home economy. Taking the example of the neighbouring Czech Republic and the Slovak Republic, their individual share of export or import not only exceeds 70% of GDP (Czech Republic; European Commission, 2020), but with 90% of GDP (Slovak Republic; European Commission, 2020) it almost "matches" volume of the respective GDP. Before their accession to the European Union (EU), a joint customs union between the neighbouring Czech Republic and the Slovak Republic regulated their individual participation in international trade as well as their bilateral trade. Since their accession to the EU both countries have been part of the EU customs union and the single European market as its upgrade. Environmental issues have increasingly been in the centre of the EU's attention and besides history shared by both countries it was globalisation that shaped their current cultural preferences.

In Parts 2 Theoretical background, 3 Methodology and 4 Results we introduced, applied and calculated water footprint. On the one hand, *ceteris paribus*, we may assume opportunity costs resulting from the showcase Ricardian model as the "simplest model that shows how differences between countries give rise to trade and gains from trade" (Krugman, Obstfeld & Melitz, 2018) such as the opportunity costs of cloth in terms of wine and vice versa. On the other hand, *ceteris paribus*, there are less obvious "opportunity costs" in the form of water footprint, with a non-linear trend between export earnings and water footprint. Such less obvious opportunity costs in the form of water footprint grow in importance especially in the case of water stress, which is according to the UN (2020) slightly higher in the Czech Republic (10-25%) than in the Slovak Republic (0-10%).

## 6 CONCLUSION

As introduced earlier, it was late 18th century that marked the classical political economy challenging the mercantilist doctrine, which was characterised by its policy of trade-surplus-driven competitiveness. Yueh (2019) argues in this regard that just like A. Smith, D. Ricardo would "urge policymakers to look at the health of the domestic economy and not focus solely on the trade position. How efficient a country is at producing goods and services will help determine its comparative advantage, and that leads to its trade balance. Aiming for a trade surplus without examining what needs to be done in the domestic economy to make exports more desirable to the rest of the world would have struck Ricardo as the wrong way to go about it."

David Ricardo's 19th-century trade theory remains highly relevant to the 21st-century world economy, as Krugman, Obstfeld and Melitz (2018) put it: "In sum, while few economists believe that the Ricardian model is a fully adequate description of the causes and consequences of world trade, its two principal implications – that productivity differences play an important role in international trade and that it is comparative rather than absolute advantage that matters – do seem to be supported by the evidence."

Our paper was structured into: Part 2 Theoretical background, where we drew on A. Smith's masterpiece *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776) with terminology of the associated Ricardian model inspired by Krugman, Obstfeld and Melitz (2018); Part 3 Methodology, in which we applied water footprint to the Ricardian model; Part 4 Results, where we calculated and presented data for the 2012-2018 total trade, trade balance as well as total water footprint balance for selected commodities; and Part 5 Discussion, in which we further interpreted opportunity costs.

In a comparative perspective of beef, pork and sheep, the Czech Republic had an absolute advantage in pork production, and the Slovak Republic had an absolute advantage in beef & sheep production. And although primary (absolute advantage) consideration of bilateral trade, *ceteris paribus*, suggested pork export specialisation in the Czech Republic and beef or sheep export specialisation in the Slovak Republic, secondary (comparative advantage) consideration would, *ceteris paribus*, admit sheep export specialisation of the Czech Republic and beef export specialisation of the Slovak Republic in bilateral trade.

In the absence of international trade the Czech Republic and the Slovak Republic would each produce the respective commodities to meet demand in their own economy; in reality (2012-2018), both the Czech Republic and the Slovak Republic registered import spending due to purchases of beef and pork rather than export earnings such as in the case of wheat and maize. Over the same period (2012-2018), beef and pork played the central role in bilateral trade balance of the Czech Republic and the Slovak Republic among selected commodities; considering the established theoretical point of view as well as the revisited competitiveness perspective with non-financial aspects such as the water footprint, one arrives at the conclusion and recommendation of a meaningful intertwined export focus of the Czech Republic (pork) and the Slovak Republic (beef) in bilateral trade. The COVID-19 crisis as the new status quo challenged the free movement of goods, services and labour across the single European market and strengthened "food nationalisation". This led to a communication campaign in the Slovak Republic promoting butcher's meat retail sales of sheep, which was traditionally exported for the Easter season to Italy, on the domestic market. In a comparative perspective with beef and pork, butcher's meat in the case of sheep, however, does not represent an affordable alternative in the Slovak Republic; therefore, "reinvented competitiveness" of butcher's meat in the case of sheep rests in the latest promo campaign on the argument of nutrition and a healthy diet. While the outbreak of the COVID-19 crisis in 2019 represents a research limit in terms of data coverage, future research might shift from a focus on the Czech Republic and the Slovak Republic to the Visegrad Group including also Poland and Hungary.

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# IMPACT OF COVID-19 ON THE ONLINE ART MARKET

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## Abstract

The aim of this paper is to outline the main features of the impact of covid-19 lockdown on the current art market with the focus on the online platforms selling contemporary art. By summarizing the data collected from long term exploration of the topic, based on the sales of various categories, styles, subjects, sizes and genders of customers globally, it is now possible to outline the main trends of the industry and changes during the beginning of covid-19 lockdown. The methodology consists of analysis of a secondary quantitative large data of one global platform hosting 10.000 artists from 108 countries plus web interviewing through detailed questionnaires answered by 35 specific artists across 12 online art selling platforms and various countries. Results show that the structure of the sales has remain surprisingly stable but the online art market as whole experienced a revival in the number of sales and new customers during the first half-year of covid-19 crisis, mostly instead of the offline art market. The key finding of our research is not only the stability of the structure in the observed areas but especially the conclusion that the strong protection of the sales of the subject present on the art market on the side of the offer during covid-19 lockdown is to be present on the global art market digitally. The online art market remained rather stable in the structure and growing in the demand while the art industry as whole suffered from empty and locked venues during the first months of covid-19 lockdown.

*Keywords: online art market, covid-19, digital era*

## 1 INTRODUCTION

What were the key features of the online art market before COVID-19 lockdown? How has the market changed during the first 6 months of the COVID-19? And how are the changes of the online art market perceived by the artists selling online? Since more than decade, the experienced art collectors and newcomers are both increasingly using websites to find original contemporary works according to Thorpe (2014) but still covering only a minority of the global art sales. The value of the online art trade has grown from around 1.507bn USD in 2013 to 4,819bn USD in 2019 according to The Hiscox Online Art Market Report 2020 (Read, 2020) and online sales have been significantly accelerated in 2020 due to COVID-19. While the global art market was valued at over 67bn USD in 2018, up from almost 64bn the previous year. The aim of this paper is to identify how exactly the lockdown of COVID-19 affected the selling subjects on the online art market and the market itself. This paper concentrates on analysis of the secondary data in one big online art sales platform Artfinder (2020) that hosts 10.000 artists from 108 countries and then detailed questioning of 35 artists that sell on 12 online platforms. The results of this research are planned to be used for further search and work and confronted with future research data. This would lead to better understanding of the specifics of this market online and offline and might help the participants of the art market to face with more ease and prepare better for situations similar to COVID-19 lockdown.

## 2 THEORETICAL BACKGROUND

There is rising evidence that the global online art market acts as separate part of the global art market as during the COVID-19 lockdown online became the sole sales channel for much of

the art industry. According to the Knetter's (1989) interpretation of the institutional theory, the subjects on the market in different types of economies react differently to similar challenges which was not proved in the online art market during COVID-19. According to the results of our research that showed structural stability of the online art market and significantly rising numbers of sales, the online art market acted as one rather homogenous market throughout global economy. Hiscox report (Read, 2020) explicitly asks whether the COVID-19 lockdown could be the moment when the art world eventually embraces digital technology." Pure online-only auction sales by Christie's, Sotheby's and Phillips generated \$370 million in the first half of 2020, which was more than five-times higher than the same period in 2019," report says. While the online presence on the art market of these three historical auction houses might be a surprise for many, Peuscher (2016) explicitly considers the role of the modern management during the process of structuring a firm's resources, bundling them into capabilities as essential in the digital era.

### **3 METHODOLOGY**

For identification of impact of the covid-19 on the online art market were used two methods. First of those methods was analysis of a secondary quantitative data collected by online art marketplace provider digital platform Artfinder (2020) that hosts 10.000 artists from 108 countries. Artfinder defines itself as the global art marketplace for wall art, original paintings, sculptures, limited edition prints and photography directly from independent artists with the focus on authentic, hand-crafted art and risk-free shopping. Second method used was computer assisted web interviewing of artists using online art market portals for selling their artwork.

#### **3.1 Research objectives**

The aim of the research was to identify how the pandemic of COVID-19 escalating in the lockdown affected the industry of fine art and specially sales of the artwork on the online market. The results of this research will be used for next work and confronted with further researched data. This would lead to better understanding of the specifics of this industry and might help the people in the industry to prepare for future occasions similar to COVID-19 lockdown crisis.

#### **3.2 Secondary research – collecting existing data**

Data analysed in the first method were collected by online art marketplace provider digital platform Artfinder (2020) on their website by their in house analytic tools. These data were provided to researches which compared the data of the first two quarters of year 2020 with data from previous year to describe the phenomena specific for this period.

#### **3.3 Primary research – collecting new data**

Primary data gathered by the second method, computer assisted web interviewing was applied on group of 35 artists who use digital portals such as Artfinder (2020) to sell their artworks online. Artists were interviewed via questionnaire created with digital tool google forms. The questions were based on secondary data gathered by first method. Aim of those questions was to confront the secondary data and identification of the respondents. Some additional questions concerning behaviour of artist and their customers on digital platforms during COVID-19 lockdown.

For analysis each artist was given number 1-35 according to the chronological order of their response to the questionnaire. The respondents of the survey gathering primary data for this

research paper where from across the whole globe. The countries of origin of responding artists are displayed in the figure 1 below.



Fig. 1 – Respondents’ countries of origin. Source: own research

## 4 RESULTS

The secondary research of Artfinder data shows that despite the pandemic of COVID-19 and the lockdown which badly affected big number of industries the online sales of artworks have flourished.

### 4.1 Analysis of secondary data

#### Sales of art at digital marketplace Artfinder in April 2020

Artfinder CEO Michal Szczesny have said in his Full Community Update at the beginning of May “Despite the pandemic, April has proven to be our best month ever” (Szczesny, 2020). With this he commented on the huge increase over 110% of new customers, who never purchased art on their platform ever before, compared to the numbers from previous year. April 2020 was the month when the COVID-19 pandemics had reached it’s so far climax. The future financial crises started to be inevitable at that time. Despite this, the same period was for art sales on digital platform Artfinder very successful. They have sold more than 3600 pieces of artwork form over 1100 artists, which is 40% increase form 656 artist from April 2019. The number of customers purchasing artworks have significantly increased across all price points. However, the biggest observable increase was concerning the number of customers placing higher value orders over \$1,000. Sales in this category have risen much more significantly by 65%. It is important to mention that this progress in sales numbers came despite restrictions and lockdowns which brought an ongoing issue with deliveries of the sold artworks.

#### Sales of art at digital marketplace Artfinder in second quarter of 2020

The same phenomenon of growth was observable on Arfinder also in next months which has escalated in June by breaking the record again and reaching year-on-year growth of 146%. Overall the last quarter of the year was despite the global COVID-19 situation very beneficial for the online art selling platform Artfinder their art sales have increased over 120% compared

2nd quarter of 2019. Another increase was recognised on average order value by 15% so not only that the number of customers have risen also did the amount of money they are willing to spent on art. (Artfinder, 2020)

**Tendencies of art sales by Category, Style and Subject on Artfinder**

Next series of figures 2-4 displays data collected by online art marketplace provider digital platform Artfinder. The figures display artworks sold on Artfinder platform sorted by Categories, Styles and Subjects. In figures we might see percentage of whole sales in two month periods for each category style or subject. Data shows that global pandemic situation caused by COVID-19 haven't affected the interest of people in specific art categories, styles or subjects and that period between March and June 2020 follows the same pattern which is described by data from period September-October 2019.

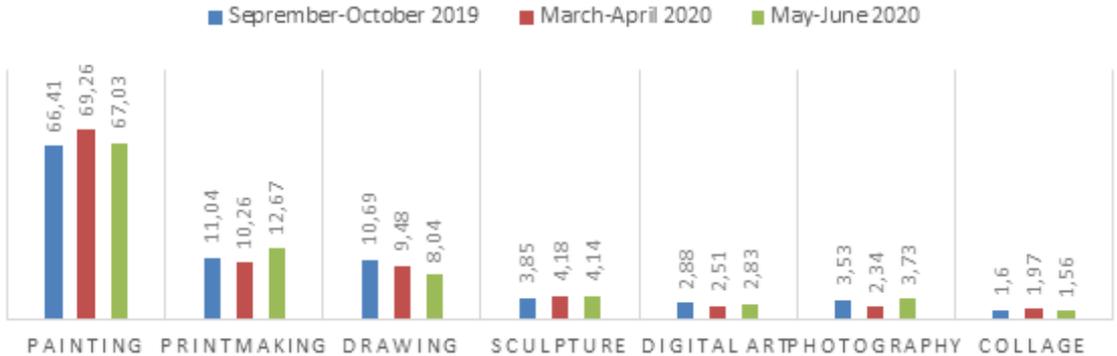


Fig. 2 – Sales by Arts Categories. Source: Artfinder (2020)

While more than 70% of sales still cover paintings while other styles, such as collage, sculpture, digital art, photography and drawing all together share about one fourth of the market. While the bestselling style are impressionism and abstract art, the bestselling subject are landscapes, people and portraits and not-figurative art. Female collectors tend to buy more art for slightly lower value than the male collectors show long term lower price elasticity, this phenomenon is closely described in next paragraph.

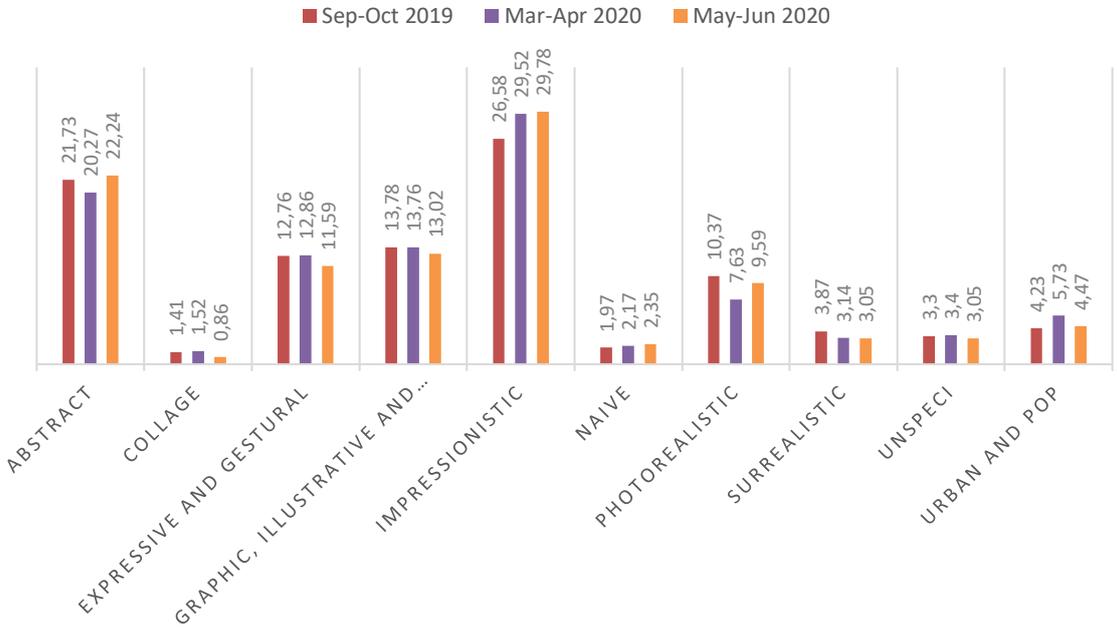


Fig. 3 – Sales by Style. Source: Artfinder (2020)

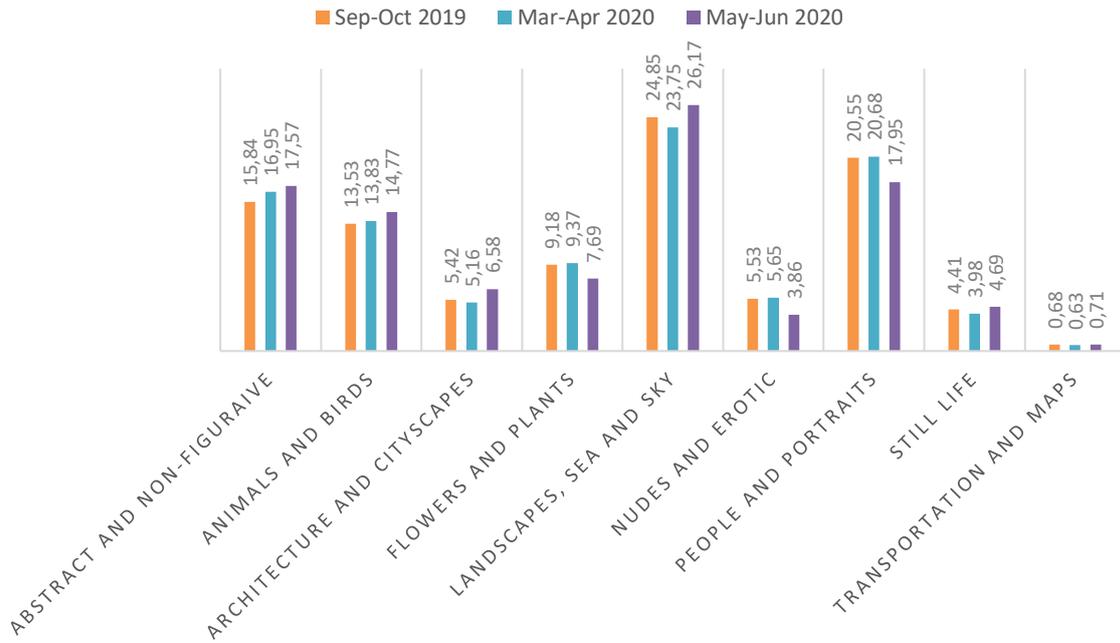


Fig. 4 – Sales by Subject. Source: Artfinder (2020)

### Gender differences in purchases

Interesting phenomenon is described in figure 5 which shows that female customers on online art marketplace provider digital platform Artfinder, perches more art then male customers but on the other hand the artworks bought by male customers has a bigger value then the artworks bought by female. Also, this phenomenon haven't been critically affected by the COVID-19 global crisis in Spring months of 2020, which data again follow the pattern described in data from fall 2019 but we can see that the differences between genders of customers are disappearing.

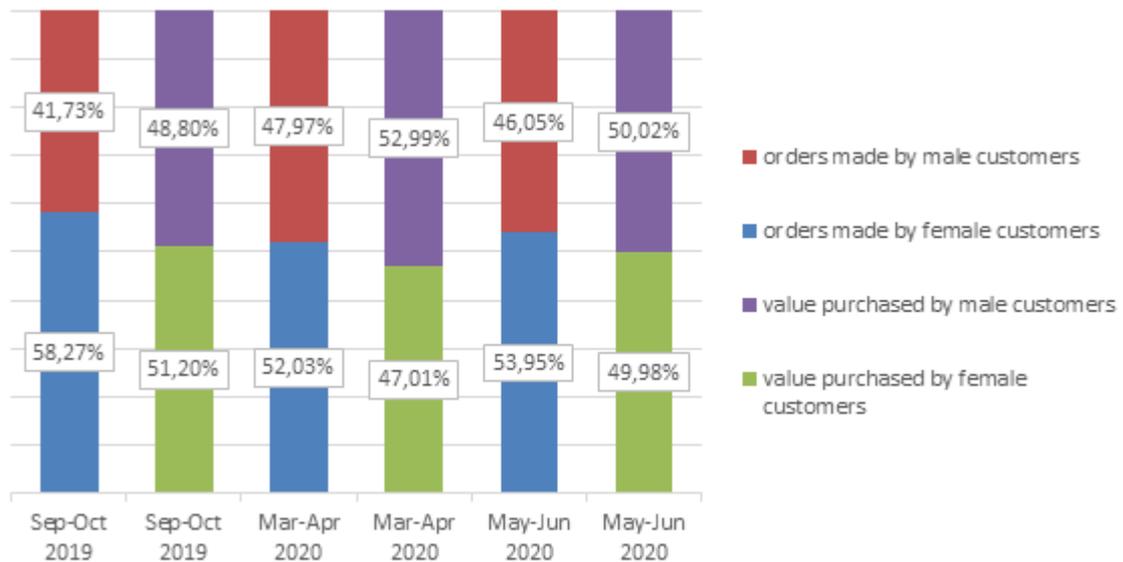


Fig. 5 – Customer gender and Sales. Source: Artfinder (2020)

## 4.2 Analysis of primary data

### Sales of art at digital marketplaces in time of COVID-19 lockdown described by Artists

This paragraph follows the phenomenon of growth described above. This phenomenon has been supported by answers of 48% of respondents of our survey, who said that their sales have risen in the time of COVID-19 lockdown, as you might see in the figure 6 23% of artist asked replied that their sails in this period had more than doubled. On the other hand there were 20% of the artist whom experienced really poor sales of less than 25% of their average sales. The important part shown in the figure below is the one in the bottom right displaying the group of 14% of the respondents which had the sails on equal level as they do in average. This piece is dividing the figure in two parts of increase on the left side and decrease on top right.

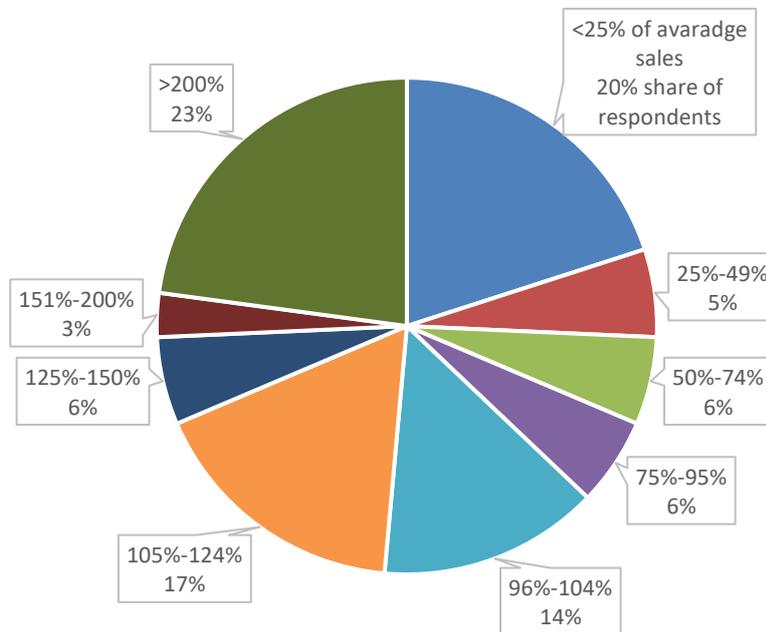


Fig. 6 – Sales during the COVID-19 lockdown described by artists. Source: own research

### Digital marketplaces used by respondents

The respondents are using in addition to Arfinder also other digital providers of similar service such as ArtGallery.co.uk, Etsy, Fine Art America, Getty, Kazoart, Notonthehighstreet, Redbubble, Saatchi, Singulart, Society6, Surrey Open Studios, The Artling, Unspecified Australian online galleries and in addition to this many of the artist mention that they use their private websites or pages on social media above the classical brick and stone galleries.

### Shipping in time of COVID-19 crises

The respondents answered in the survey also few open questions which were aiming to get and insight of the problematics from the artist's point of view. In answers to those questions had the artists described quite interesting phenomena caused or affected by COVID-19 crises. In those answers artist describe the peculiarities of this period such as shipping problems connected with closure of state borders. They had described that those difficulties were overall well accepted by customers. One of the respondents said "They seem a bit more patient with regards to shipping."(Artist no.24). On the other hand one of the artists describes that this specific period made him to make changes in his pricing policy due to different shipping options and costs: "I had to increase postage prices to accommodate postal restrictions and limited priority shipping options."(Artist no.35). On the other hand some described that their customers weren't very pleased with occasions "Customers worried about long delivery of paintings"(Artist no.34).

### **Artists approach in time of COVID-19 crises**

Another points regarding the period of COVID-19 lockdown are about the free time and atmosphere that artists have experienced. Some say that they were more productive in this free time “During the pandemic, I created a lot of new work to cheer up”(Artist no.9). Some of them had devoted the time they had to maintain their online sales “I have monitored the website more proactively,”( Artist no.27) or “I also made discounts on old works”(artist no.9). On the other hand there were some artist whose sales had recognised significant decrees in this period said that “I was not active at marketplaces during the lockdown”(Artist no.29).

### **Customers behaviour in time of COVID-19 crises**

Artists have also described the changes in behaviour of their customers which was affected by the COVID-19 crisis, such as “people had more time to search for art work, rather than just looking at the first few pages.”(Artist no.7) this artist reacts on the way how online art marketplaces platforms work and how they display the offers to the customers. Another artist describes it even further that the customers “have sort out my work across several websites”(Artist no.27). Other artist support this phenomenon by “More online views, more sales, more feedback”(Artist no.16) done by their customers or “I've seen increased views, and followers of my work.”(Artist no.22).

## **5 DISCUSSION**

The sudden COVID-19 lockdown caused serious complications (Nguyen, 2020, Pravec, 2020, Schwarz, 2019) on all sides, from the art supply, the transportation issues to the inspiration art traveling ban. The galleries, auction houses were closed down and the brick and mortar based art business was in many cases transferred to the online market which might eventually lead to the long-term expected digital revolution of the industry (Read, 2020). As contrast to this crisis of the suddenly fragile classic art market, the online art community became quite resistant to the issues by sharing their experiences and warnings online, supportive approach, cooperation and generosity (Crick, 2020, Hirsch, 2020, Horwitz, 2014). This digitally enabled cooperation and communication of the subjects on the art market transformed into large increase of the online sales.

Further researches are planned in the future so the authors can get more complex understanding of the problem. There is a limitation in the secondary research caused by having only one source. In the future authors have an aim to gather data from other platforms then Artfinder. Cooperation with those platforms is already in progress. The limit of the second method is the limited number of questions used in written questionnaire and difficulties to keep respondents attention. In the research where gathered contacts for artists who are willing to assist in further research which is planned to be Depth Interview via online video meeting service.

## **6 CONCLUSION**

The research shows that contrary to the global art industry as whole that suffered from closed galleries, locked down brick and mortar art supply shops, limited or delayed transportation services and struggling art tourism, the online art market remained rather stable in the structure and speeded-up growing in the number of new customers and sales. The striking feature of the climate of the online art market during the first six months of lockdown was a unique combination of fast and precise digital world on one side fused with human solidarity and generosity of artists and their customers on the other side. The philosophical explanation of the online art market revival during covid-19 lockdown would though probably state that online art market survived so well especially because of getting the best from both of the worlds: the

human and the digital. By substituting the physical economic exchanges with global offer and global demand, fast digital transactions and exchanges of taste, values and finances on one side were combined with human approach on the other side where customers showed generosity and solidarity with delays, transportation and limited access to art tools issues. Of course, only the time will show if this is a long-term trend. Together with many subjects on the online art market the authors of the research agree that COVID-19 could strongly accelerate the global art world's jump to the long-expected digital transformation. The conclusion of our research is though that the strong protection of the sales during covid-19 lockdown for the artists and the galleries is to be present on the global online market.

### **Acknowledgement**

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# ADOPTION OF E-PERFORMANCE APPRAISAL FOR EMPLOYEE WORKING FROM HOME IN A LESS INTERNET-PENETRATED TERRITORY- A CONCEPTUAL FRAMEWORK

*Alex Ntsiful, Boris Popesko, Michael Adu Kwarteng*

## **Abstract**

The need for working from home practices has heightened given the current coronavirus (COVID-19) pandemic that is bedevilling the world. However, how to appraise employees working from home remains a challenge. Thus, the purpose of this study was to provide an understanding on the factors, which could affect managers' decision to adopt e-performance appraisal system to monitor and assess their employees working from home in the less internet-endowed environments such as Ghana. Using literature search as a method and drawing on the constructs of the Technology Acceptance Model, the study reviewed an extensive literature on how perceived usefulness, perceived ease of use, perceived cost and facilitating conditions affect the adoption of e-performance appraisal. The study found a model, which proposes that perceived usefulness and facilitating conditions will positively affect managers' intention to adopt e-performance appraisal. Further, perceived ease of use will not only have a direct positive effect but also have an indirect positive effect on the intention to adopt e-performance appraisal via perceived usefulness. The model also proposes that perceived cost will negatively affect managers' e-performance appraisal adoption intention. We make a recommendation on the need for future study to use our model and test empirically these propositions from the study's findings.

*Keywords: e-performance appraisal, electronic performance management, working from home, COVID-19, technology acceptance model*

## **1 INTRODUCTION**

Given the sombre circumstance the world finds itself because of COVID-19 pandemic, remote working practices (RWP) in general and working from home (WFH) in particular is not just an option but also a preferred choice for many organizations. Apart from the adherence to directives from the government on the pandemic, well-meaning organizations and technology-driven firms have already adopted WFH practices. Report indicates that many employers have endorsed WHF option for employees especially those with white-collar jobs (Rofcanin & Anand, 2020). For instance, in America, Bagnera et al. (2020) indicate that the COVID-19 pandemic has forced many businesses to opt for WFH strategies. Even before the Covid-19 pandemic started, International Data Corporation (IDC) had predicted that by 2020, the number of remote workers which stood at 96.2 million in 2015 would increase to about 105.4 million (International data centre, 2015). Vodafone Ghana has also encouraged most of their employees to work from home due to the COVID-19 pandemic (Vodafone Ghana, 2020). It is further argued that the adoption of WFH strategies becomes inevitable in this pandemic period because we see countries reporting a relapse as they attempt to resume work. However, the decision to adopt WFH practices is not easily concluded as the WFH comes with a myriad of challenges. For instance, aside from the tendency for employees to overwork themselves out, perceived feeling of alienation from the organization, it is also reported that it is difficult for workers to separate work from home when they opt for WFH (Baytcom, 2015; Nytimescom, 2013).

Another key challenge, which is the focus of this paper, is the problem of appraising the performance of employee working from home. In this regard, extant studies have argued that measuring the performance of WFH employees is difficult and literally, supervisors perceive that these employees may not be working (Timsal & Awais, 2016; Bloom, 2014). However, the exigencies of the current COVID-19 pandemic makes the adoption of WFP indispensable and there is, therefore, the need to find a way of monitoring and appraising the performance of WFH employees. One obvious way is the use of the e-performance appraisal, which involves the use of electronic means to evaluate the work of employees. Studies in advanced world have reported that employees on WFH arrangement use information system infrastructure such as email, skype, VoIP, instant messaging, video conferencing facilities, and Microsoft Lynn, for communicating with their colleagues and managers (Wright, 2020; Rysavy & Michalak, 2020). One would, thus argue that, given these platforms of communication, managers can also use the same platforms to remotely monitor and assess employee's performance when working from home. However, most of these information system infrastructures may be expensive to some firms and most importantly are internet-driven. This presents a big challenge to managers or employers in a less internet-endowed environment. By less internet-penetrated territory, we mean countries where internet supply is not stable, and or access to the internet is minimal and relatively expensive.

Given these arguments, the key objective of the paper is to provide an understanding on the factors, which could affect managers' intention to adopt e-performance appraisal system to monitor and assess their employees working from home in the less internet-endowed environments such as Ghana. Specifically, by anchoring on the Technology Acceptance Model-TAM (Davis, 1986), the study presents a literature review of previous studies in the field of technology adoption in general and e-performance appraisal in context. It then makes propositions on how perceived usefulness (PU), perceived ease of use (PEoU) of TAM, and two additional variables: perceived cost and facilitating conditions, affect the adoption of e-performance appraisal. Although TAM is credited for its parsimony, many studies extend it with other variables to ensure full understanding of the phenomena being studied (Wang et al., 2020; Tarhini, et al., 2017; Abdullah & Ward, 2016; Saleh & Saleh, 2016), thus the inclusion of the additional two variables justified.

This study is relevant for three reasons. First, it sets the tone for empirical studies. Second, it is one of the few studies that have used TAM in human resource management in general and particularly in the context of the e-performance appraisal. Lastly, it proposes to extend the TAM with perceived cost and facilitating conditions.

The rest of the paper is organized as follows: Following this introductory section is section 2, which reviews the literature on TAM and the study's main variables and makes some propositions. This is followed by section 3 describing the study's methodology. Section 4 discusses the findings while section 5 makes the conclusion and provides directions for future research.

## **2 LITERATURE REVIEW & RESEARCH PROPOSITIONS**

### **E-performance appraisal**

E-performance appraisal refers to the use of intranet and internet to assess the knowledge, skills and performance of employees (Nivlouei, 2014). In a broad sense, e-performance appraisal involves the use of digital means to assess an employee, a team or an organization's performance by comparing the targets set with the actual target achieved. Traditionally, performance appraisal involves face-to-face interaction between employee and supervisor to

agree on performance expectation and assessment of how well the employee has performed on a given task within a given period. Specifically, traditional performance appraisal consists of agreeing on performance targets, providing support and feedback by managers, and a review of actual performance against the target set. (Frederiksen et al., 2017; Kurtzberg et al., 2005). Thus, e-performance uses digital devices, and internet to set a performance target, provide support and feedback, and review the actual performance of employees. This means in the e-performance appraisal, all the processes involved in the traditional performance appraisal such as setting and review of targets would be done remotely with the support of information system infrastructure.

Performance appraisal serves several purposes including an opportunity to give performance feedback, use for pay increment decisions, terminations, goal setting and measurement, determine training and development needs, and to encourage performance improvement (Grote, 2002). Given this myriad of uses of performance appraisal, it is expected that e-performance appraisal is also conducted effectively to bring desired results. It is argued that if the e-performance appraisal is not conducted effectively, the employee or the employer may suffer. For instance, if WFH employee is underrated by the new system, the employer may suffer because employees may be promoted where they do not deserve the promotion. On the other hand, an employee may also suffer several performance-feedback penalties up to and including termination of appointment when indeed the basis was wrong.

### **Technology acceptance model**

Postulated by Davis (1986), the technology acceptance model (TAM) assumes that a user perception and acceptance of new technologies or innovation is influenced by two key factors, namely perceived usefulness (PU) and perceived ease of use (PEoU). Davis explains that while the PU measures the extent to which an individual believes adopting a particular technology or system would improve performance, the PEoU measures the degree to which a person believes that adopting a particular technology or system would be less difficult to use.

Conceptually, in this study, PU is considered as the extent to which firms operating in less internet environment would find the use of e-performance appraisal as capable of enhancing the appraisal of their employees working from home. Similarly, in this study's context PEoU is defined, as the extent to firms in operating in less internet endowed economies would use the e-performance appraisal for their employees working from home without difficulties. Many extant studies have used TAM to predict acceptance of adoption of innovation (Giri et al., 2019; Gökteş & Akgül, 2019; Mallya & Lakshminarayanan, 2017; Zhang et al., 2019). For instance, whilst Giri et al. (2019) use TAM to predict the adoption of e-human resource management, Zhang et al. (2019) adopted it determine how green human resource management in India influences green employee behaviour. Further, Huang and Martin-Taylor (2013) utilize the same model to measure users' acceptance of HR self-service system in the UK. PEoU directly affects intention to use a system or indirectly via PU influences the individual's intention to use the system (Davis, 1986).

Extant studies have confirmed that both PU and PEoU relate positively with users' intention to adopt new technologies (Amin et al., 2014; Singh & Srivastava, 2018; Yusoff et al., 2010). Unlike the traditional appraisal system which involves paper-pencil or face-to-face meeting, e-performance appraisal can be affected many factors such the digital devices, internet connectivity, and home background noise where the appraisee is located and these can affect PU and PEoU. Thus, if the e-performance appraisal is useful and easy to use, it is more likely that users will accept it. Based on the above discussions, the following propositions can be derived:

**P1:** *Perceived usefulness will positively influence the adoption of e-performance appraisal*

**P2:** *Perceived ease of use will positively influence the adoption of e-performance appraisal*

**P3:** *Perceived ease of use will positively influence perceived usefulness of e-performance appraisal*

### **Perceived cost and adoption of e-performance appraisal**

According to Machogu and Okiko (2012), perceived cost refers to the overall expenses incurred in adopting the technology. Perceived cost in acquiring a new technology may include the cost of hardware, software, subscription fee and many more. In this study, the adoption of e-performance appraisal refers to the managers' willingness and decision to use electronic means to monitor and appraise the performance of their employees on WFH option. Thus, the perceived cost is an essential factor affecting a user's intention to adopt the technology (see; Fonchamnyo, 2013; Kim & Shin, 2015;). Specifically, perceived cost negatively affect intention to use technology and has been a barrier to technology acceptance (AlSoufi & Ali, 2014; Machogu & Okiko, 2012). Contextually, this study also defines perceived cost as the total cost associated with adopting and implementing e-performance appraisal. The study contends that in accepting e-performance appraisal for employees working from home, organizations would incur cost such as cost of digital devices, software, cost of subscribing to online conference tools like WebEx, zoom, skype, and most importantly internet cost. For instance, when employees are on WFH, the firm would have to provide stable internet or internet data for them. Thus, where the perceived cost is high, it will affect the adoption of the e-performance appraisal. Following the above, it is proposed that:

**P4:** *Perceived cost of use will negatively influence the adoption of e-performance appraisal*

### **Facilitating conditions and adoption of e-performance appraisal**

Facilitating condition is defined as the user's perception of the extent to which a firm has the necessary organizational and technical resources to aid in the adoption of new technology (Venkatesh et al., 2003). Contextually, however, the study defines the facilitating condition as the degree to which an organization has stable and affordable internet, and power supply to aid in the use of e-performance appraisal to assess its employees working from home. The study argues that in developing economy such as Ghana, facilitating conditions such as internet connectivity is erratic, slow, unreliable and most importantly expensive. Added to this conundrum is an unstable power supply. These factors are envisaged to pose a challenge to e-performance appraisal adoption. Extant literature has found that facilitating condition positively affect technology adoption (Alraja, 2016; Mahardika et al., 2019). Thus, this study also proposes that:

**P5:** *Facilitating conditions such as the internet will positively influence the adoption of e-performance appraisal*

## **3 METHODOLOGY**

The study adopted a literature search as a method. Specifically, the study sourced 85 articles from Web of Science, Scopus, and Google scholar. These databases are believed to have articles with good impact factor and article influence score. The study used keywords and phrases such as electronic performance appraisal, e-performance appraisal, e-HRM, technology acceptance model, extended TAM +e-performance appraisal or e-HRM, working from home practices in Ghana. This search formula pulled articles, journals and other research outputs. After these data

were extracted from the stated search engines and databases, they were examined for relevance. The relevance check reduced the total articles to 27, which were deemed useful for the study.

#### 4 FINDINGS & DISCUSSIONS

The key research question of this paper relates to the factors, which could affect the adoption of the e-performance appraisal. The study found an extended TAM model (see figure 1. Out of this model, the study also found five propositions, which could be tested empirically. These propositions are stated below:

- P1:** *Perceived usefulness will positively influence the adoption of e-performance appraisal*
- P2:** *Perceived ease of use will positively influence the adoption of e-performance appraisal*
- P3:** *Perceived ease of use will positively influence perceived usefulness of e-performance appraisal*
- P4:** *Perceived cost of use will negatively influence the adoption of e-performance appraisal*
- P5:** *Facilitating conditions such as the internet will positively influence the adoption of e-performance appraisal*

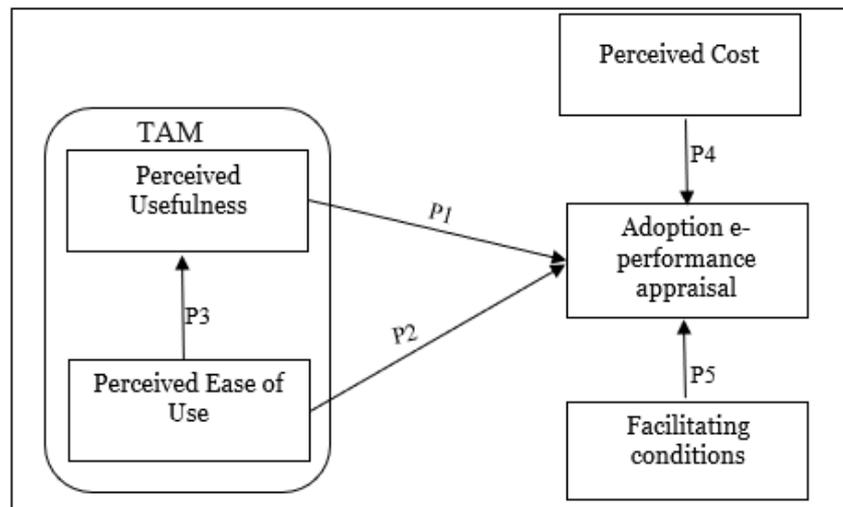


Fig. 1 – Conceptual framework. Source: own research

Specifically, the perceived usefulness, perceived ease of use, perceived cost and facilitating conditions could affect managers' intentions to adopt e-performance appraisal to monitor and assess the performance of employees working from home. It was noted that new technology could be accepted if it promises to improve the performance of existing work methods (in this case traditional appraisal system). In this regard, if e-performance appraisal system cannot improve the traditional appraisal system, it should be at least a good replacement for it to be accepted. This means the new system should help managers to assess their WFH employees in a manner that is at least equivalent to the traditional method of appraisal. Further, the e-performance appraisal is likely to be accepted if it is not so complex to use. For instance, if a manager is adopting a zoom platform as a communication tool to assess employees working from home, then the platform should of less technical and mental effort to use; otherwise, it may not be accepted.

Aside from these, the cost of adopting e-performance appraisal system also plays a key role in determining an employer's willingness to adopt the technology. For the new appraisal system to be adopted, the cost of adoption must be affordable to the organization. The organization

would engage in a cost-benefit analysis to determine whether it worth it or not. Where the cost is unreasonably high for the organization, resistance to or rejection of e-performance appraisal system is highly possible. Again, although e-performance appraisal system may prove to be useful, easy to use and cost-friendly, facilitating conditions such as the stable power and internet supply is key to its acceptance. It is therefore important that government improve on these infrastructures.

## **5 CONCLUSION, LIMITATIONS & FUTURE RESEARCH DIRECTION**

The key objective of the paper was to provide an understanding on the factors, which could affect e-performance appraisal adoption by organizations whose employees are working from home in less internet-endowed environments. The study concludes that perceived usefulness, perceived ease of use, perceived cost and facilitating conditions are potential key factors, which could affect the adoption of e-performance appraisal in such environments. However, it is worth noting that generalization of the study's findings is not possible because they were not empirically tested and that is a key limitation of the study. Again, the few databases from which the study's data were generated also needs to be noted as a possible limitation. Despite these limitations, the study offers a solid framework from which future research can adopt to test empirically and confirm the propositions so stated. Theoretically, the study has set a tone calling for future research into the possibility of extending TAM with perceived cost and facilitating conditions in the context of e-performance management in a less penetrated internet economy. As a conceptual study, this paper would be further developed empirically. Data would be collected through an online survey of managers' intention to adopt e-performance appraisal for employees in the service sector in Africa with Ghana as study's site where internet and other conditions may pose as challenges. The study also recommends to future studies to examine whether exigencies like COVID-19 pandemic could moderate or mediate the factors influencing new technology adoption.

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# ENTERPRISE ENVIRONMENT ASSESSMENT WITHIN THE EU COUNTRIES BASED ON GLOBAL MULTICRITERIA INDICES

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## Abstract

The role of enterprises in economic development cannot be underestimated. Enterprises play a vital role in the economic growth. The main aim of the paper is to assess the enterprise environment on the basis of two selected international multicriteria indices - the Doing Business Index and the Global Entrepreneurship Index. The research was performed within the EU member states during the period 2010-2019. Moreover, in order to categorize countries of the EU, a multidimensional classification of countries was realized by applying Ward's hierarchical clustering method based on the Euclidean distance. The purpose of the categorization was to find out whether disparities in entrepreneurship among countries have reduced over the period analysed, as well as, to provide recommendations improving the business background. Based on the results, it can be stated that the environment for doing business have improved within the EU economies for the last 10 years. The decreasing values of Euclidean distance indicated a reduction of disparities among countries in terms of doing business assessment. In this backdrop, the answer to the research question is formulated positively. However, it is still necessary to eliminate some barriers. Considering both selected global indices, to the best-performing countries belong Denmark, United Kingdom and Sweden. On the contrary, countries such as Malta, Romania and Greece were quantified as the worst-performing in creating conditions for entrepreneurship. Thus, the research findings enable to compare the level of business prosperity of countries and they are useful in suggesting targeted business strategies translated into different types of action plans.

**Keywords:** *business environment, EU member states, Doing Business Index, Global Entrepreneurship Index, cluster analysis*

## 1 INTRODUCTION

Enterprises belong to the key driver for the economic development of the countries. They represent a strong potential to create a large number of jobs with a connection to innovation development and growing income (Rogalska, 2018). In many countries, policies are set up to eliminate obstacles to enterprise development and ensure conditions for their prosperity.

Development in entrepreneurship is carried by running private firms. In achieving higher macroeconomic growth, entrepreneurship conditions are particularly important, as they influence the quality of business environment, which is conducive to obtaining final positive financial results. As reported by the World Bank Group (2019), the private sector generates 90% of jobs, funds 60% of all investments and provides more than 80% of government revenues. Moreover, private companies are providing an ever-increasing share of essential services. Sustainable private sector-led growth contributes to the reducing poverty and increasing economic prosperity. To make this happen, the private sector needs to be encouraged and supported at international, as well as, national level. In this context, the government plays a central role. The vast majority of constraints to growth identified by the private sector are directly linked to government decisions and action. The effective implementation of national policies is important prerequisites to ensure the private sector can thrive.

The importance of evaluation of entrepreneurship environment is emphasized also by European Commission & OECD (2013). Enterprise evaluation is needed to demonstrate impacts and justify spending and to improve enterprise policy by learning from experience. Key issues to be assessed include the relevance, effectiveness and efficiency of policy inclusive entrepreneurship programmes. As reported by Ionescu, Cornescu and Druică (2011), sustainable development of European Union, in conformity with objectives and provisions of “Europe of 2020” Strategy, is based on prosperity of enterprises sector. European Union’s efforts must focus on creating a favourable environment for entrepreneur initiatives.

The importance of this issue led the authors to undertake research focused on the enterprise environment assessment within the EU member states. This paper is divided into following sections. The first section contains an overview of previous studies regarding the assessing of enterprise environment, as well as, the literature review concerning two selected international indices. The second section contents research methodology and used statistical methods description. The next sections present the results achieved and discussion. The paper ends with the main research findings, limitations and recommendations for future research.

## **2 LITERATURE REVIEW**

A high-quality enterprise environment represents a prerequisite for long-term economic growth. Business sector contributes to increase of country's competitiveness and business conditions are decisive for the inflow of investments. In the literature, authors present a huge number of business environment-related factors. In this backdrop, it can be stated that enterprise environment is a complex variable.

As reported by Belas et al. (2019), many barriers to enterprise development are of a long-term nature. Enterprises are disadvantaged by many factors, for example discriminatory income tax, permanent changes to legislation and its lack of transparency, high administrative burden, problematic law enforcement and legal uncertainty, inactive capital market, concerns about business risks and inadequate motivation for business development. The study of Gamidullaeva, Vasin and Wise (2020) measured institutional environment quality through the identification of regional-level determinants in order to determine variation in entrepreneurial ecosystems. The shadow economy, corruption, access to finance and instability in the political and economic field were indicated as the most severe obstacles to SME development. Rialp-Criado and Komochkova (2017) demonstrated a strong link between the business environment and business activities. Authors stated that increasing the export intensity of enterprises depends on the alignment of their technology innovation strategy with the local institutional environment. Torkkeli et al. (2019) analysed the institutional forces impacting entrepreneurship and they found that the institutional environment of a country can either significantly drive or prevent certain types of entrepreneurial activity. As reported by Nguimkeu (2016), institutional reforms, credit constraints and infrastructure shortages affect the gross margins of companies negatively. Cepel et al. (2020) constructed a structural model of correlations between the business environment quality and factors determining the quality of the business environment. Based on the research findings, authors interpreted that to the most important factors were included the macroeconomic growth, followed by monetary policy and interest rates, as well as, the state regulation and business support. Perez-De-Lema et al. (2019) investigated the influence of the business environment on innovative activity and performance enterprises. In this context authors concluded that the conditions of business environment significantly determine the implementation of innovation strategies, the level of financial performance and its dynamism. The problems and perspectives of the international business environment from the point of view foreign trade were analysed by Hrechyshkina and Samakhavets (2019).

Particular attention was paid to the internal and external factors restraining export potential. Authors examined export difficulties (non-adequate economic requirements of countries) as soon as possible. In the research paper provided by Gaganis, Pasiouras and Voulgari (2019) was examined how country-specific business characteristics shape the profitability of SMEs. The research sample of 40,000 enterprises operating in 25 EU countries over the period 2006-2014 was analysed. Authors found that freedom from corruption, a better environment in terms of the conditions that could contribute to the ease of getting credit, and fewer government regulation related to the starting, operating, and closing a business, enhance profitability. Moreover, the enterprise profitability depends on political stability and institutional quality. Smirnov et al. (2019) addressed the impact of business environment factors on entrepreneurship activity. As a result of the cluster analysis, there have been revealed several key factors - the time of "entry" into the business and "exit" of it, solvency, market capacity and fiscal burden.

As reported by Huttmanova and Valentiny (2019) and Huttmanova, Novotny and Valentiny (2019), in the process of sustainable development of the EU countries, it is essential to analyse the components of a sustainable development. Many international organizations and policymakers develop and implement monitoring systems and tools to map and evaluate different areas of economic development. According to Sira et al. (2017), many global institutions are devoted to annual evaluations of countries against a variety of criteria which are transformed to scores and indices. Results are presented in reports. So far, there were developed various indices that seek to synthesize the doing business factors. To the worldwide-well know and wide-spread measures belong Doing Business Index and Global Entrepreneurship Index.

### **Doing Business Index**

In order to evaluate enterprise environment of countries, the World Bank Group suggested the Doing Business Index (DBI), providing objective measure tool for assessing various aspects of enterprise conditions at international level. The research specifically focused on one business environment assessment using the DBI was presented by Estevao et al. (2020). The survey compared the African countries over the years 2008-2017. Authors stated that credit is not the determining factor for the ease of doing business and difficulties in dealing with the authorities are highly significant. Tan, Gopalan and Nguyen (2019) introduced a novel index that measures ease of doing business at the sub-national level. They created a comprehensive index constructed using 81 indicators, capturing attractiveness to investors, business friendliness and competitive policies. Based on findings, authors stated that easing the administrative impediments to doing business represents a pre-requisite to enhance foreign investments. The issue of enterprise environment expressed through Ease of Doing Business in relation to competitiveness of countries was analysed by Hossain et al. (2018). Research results confirmed the Ease of doing business enables inward foreign direct investment through better contract enforcements, getting credit and registering property. The today's conditions of doing business at international level were analysed also by Tkachuk and Khachatryan (2019). Authors presented that the level of corruption, imperfect legislation, and volatile tax system negatively affect the activities of businesses. An effective business development in the EU required stable economic market, honest legislation, and state support. Musienko and Tulepbekova (2019) examined the World Bank ranking used for evaluating country's business climate. A comparative analysis of main drivers of the Doing Business ranking system was made for evaluating its strengths and weaknesses. The influence of selected macroeconomic factors on the dynamics of entrepreneurial activity measured by the DBI in 18 EU countries for a period of 14 years was investigated by Rusu and Roman (2017). The findings of study revealed that inflation rate, foreign direct investments, access to finance and total tax rate belong to the key macroeconomic determinants of entrepreneurship. Fabus (2018) also assessed business

environment using various components of DBI, namely a legislative framework for business and law enforcement, administrative and financial (tax and fee) burdens, interference with business freedom and business infrastructure (conditions, quality and availability of key factors of production and business services). Based on the paper findings, to the decisive areas belong factors as the sources of enterprise financing, unemployment rate, human resources and social policy.

### **Global Entrepreneurship Index**

Based on an efficiency analysis of the Global Entrepreneurship Index (GEI), Inacio et al. (2020) demonstrated that the Key Performance Indicators' analysis leads to incorrect interpretation of the entrepreneurship dynamics. Study categorized GEI indicators into output and input indicators. Following this attitude, each dimension was investigated separately and then compared to each other, considering countries' productivity rates. The findings of the analysis showed that innovation-driven economies with lower positions in GEI ranking often have higher productivity rates when compared to economies with higher positions in GEI ranking. Faghieh, Bonyadi and Sarreshtehdari (2019) generated two new indexes - the Entrepreneurial attitude index and the Entrepreneurship capacity index based on the Global Entrepreneurship Monitor (GEM) dataset. Within the study, a non-linear regression approach to discussing the relationship between these indexes was introduced. By using statistical methods was confirmed that the entrepreneurship attitude index is able to improve the economic categorization of countries. Entrepreneurship performance at the national level through a new approach GEI was measured by Ha and Hoa (2018). By analysing these pillars and variables in comparison to two Southeast Asian developing economies which have similar cultural, economic and social characteristics, the study identified the best and worst performing variables of the GEI. Acs et al. (2015) constructed the Global Entrepreneurship and Development Index (GEDI) that captures features of entrepreneurship across Spanish regions. Using institutional data and survey data, weaknesses in the incentive structure that affect regional development were identified. The entrepreneurial disparities among regions were analysed at the country and regional levels using a penalty for bottleneck methodology. The methodology allowed public policy action to be coordinated at both national and regional levels. Authors found that GEDI provides a valuable tool for understanding regional differences. As reported by Coduras and Autio (2013), entrepreneurship research is progressing towards the construction of indexes that integrate the information of the three predominant approaches: the entrepreneurial activity output, the population's entrepreneurial values and the context in which entrepreneurship takes place. The obtained results demonstrated that the GEM provides relevant qualitative details.

## **3 METHODOLOGY**

The enterprise environment is subjected to many economic, political and social trends. Entrepreneurship activities are associated with economic effects at national and international level. Furthermore, a high-quality business environment is one of the basic prerequisites for the healthy economic development of a country. In this context, the above-mentioned determinants served as the main stimulus for analysis performed.

The main aim of the paper is to assess the enterprise environment within the EU member states on the basis of two selected international multicriteria indices (DBI and GEI) for the period 2010-2019. In this regard, a multidimensional classification of countries was performed. By using cluster analysis, the EU member countries were categorized into clusters, in order to find out whether entrepreneurship disparities have been eliminated over the period analysed. The partial purpose was to formulate recommendations for individual clusters enabling enterprise environment improvement.

In the backdrop of the aim settled, the following research question (RQ) was formulated: *Have the enterprise environment disparities of the EU member states reduced over the years 2010-2019 in terms of the selected international indices (DBI and GEI)?*

## Data description

The entrepreneurship development of the EU member states was quantified using two selected composite indices (namely the DBI and the GEI) annually issued by world-renowned institutions. Both indices represent comprehensive integrated tools for assessing the level of enterprises prosperity. The cluster analysis was performed separately in 2010 and 2019, with a focus on monitoring changes in enterprise environment for 10 years' time period. The methodological framework of selected global indices is described in the following part.

Since 2003, the World Bank Group has published an annual report entitled *Doing Business*, measures various aspects of business regulation affecting small domestic firms located in the largest business city, as well as, assesses barriers to doing business in the world's advanced economies. The Doing Business report does not explain all variables influencing business decision-making. According to experts' suggestions, the DBI focuses on only significant determinants of the business environment. The latest report published in 2020 includes up to 190 countries. Doing Business report 2020 covers 12 aspects of business regulation, at which ten of these areas are included in the ease of doing business score and ease of doing business ranking. Two areas - the Employing workers and Contracting with the government indicator sets are not part of Doing Business 2020. The structure of DBI is shown in Table 1.

Tab. 1 – The framework of Doing Business Index. Source: World Bank Group (2020)

	Areas of business regulation	Indicators
<b>DOING BUSINESS INDEX</b>	1. Starting a business	<ul style="list-style-type: none"> <li>▪ Procedures</li> <li>▪ Time</li> <li>▪ Cost</li> <li>▪ Minimum capital</li> </ul>
	2. Dealing with construction permits	<ul style="list-style-type: none"> <li>▪ Procedures</li> <li>▪ Time</li> <li>▪ Cost</li> <li>▪ Building quality control index</li> </ul>
	3. Getting electricity	<ul style="list-style-type: none"> <li>▪ Procedures</li> <li>▪ Time</li> <li>▪ Cost</li> <li>▪ Reliability of supply and transparency of tariffs index</li> </ul>
	4. Registering property	<ul style="list-style-type: none"> <li>▪ Procedures</li> <li>▪ Time</li> <li>▪ Cost</li> <li>▪ Quality of land administration index</li> </ul>
	5. Getting credit	<ul style="list-style-type: none"> <li>▪ Strength of legal rights index</li> <li>▪ Depth of credit information index</li> </ul>
	6. Protecting minority investors	<ul style="list-style-type: none"> <li>▪ Extent of disclosure index</li> <li>▪ Extent of director liability index</li> <li>▪ Ease of shareholder suits index</li> <li>▪ Extent of shareholder rights index</li> <li>▪ Extent of ownership and control index</li> <li>▪ Extent of corporate transparency index</li> </ul>
	7. Paying taxes	<ul style="list-style-type: none"> <li>▪ Payments</li> <li>▪ Time</li> <li>▪ Total tax and contribution rate</li> <li>▪ Postfiling rate</li> <li>▪ Time to comply with VAT refund</li> <li>▪ Time to obtain VAT refund</li> <li>▪ Time to comply with corporate income tax</li> <li>▪ Time to complete a corporate income tax</li> </ul>
	8. Trading across borders	<ul style="list-style-type: none"> <li>▪ Time to export</li> <li>▪ Cost to export</li> <li>▪ Time to import</li> <li>▪ Cost to import</li> </ul>
	9. Enforcing contracts	<ul style="list-style-type: none"> <li>▪ Time</li> <li>▪ Cost</li> <li>▪ Quality of judicial processes index</li> </ul>
	10. Resolving insolvency	<ul style="list-style-type: none"> <li>▪ Recovery rate</li> <li>▪ Strength of insolvency framework index</li> </ul>
	11. Employing workers	<ul style="list-style-type: none"> <li>▪ Flexibility in employment regulation</li> </ul>
	12. Contracting with the government	<ul style="list-style-type: none"> <li>▪ Procedures and time to participate in and win a works contract through public procurement and the public procurement regulatory framework</li> </ul>

Doing Business presents results for two aggregate measures: the ease of doing business score and the ease of doing business ranking. The ease of doing business score measures an economy's performance with respect to a measure of regulatory best practice across the entire sample of 41 indicators for 10 Doing Business topics. Doing Business methodology uses the simplest method: weighting all topics equally and, within each topic, giving equal weight to each of the

topic components. An economy's score is indicated on a scale from 0 to 100, where 0 represents the worst regulatory performance and 100 the best regulatory performance. In any given year, the score measures how close an economy is to the best regulatory performance at that time. The ease of doing business ranking compares economies with one another. For the last 17 years, more than 48,000 professionals have assisted in providing the data that inform the Doing Business indicators (World Bank Group, 2020).

The first report introducing the Global Entrepreneurship Index (GEI) was issued in 2009 by The Global Entrepreneurship and Development Institute (GEDI). The above-mentioned institute's flagship project was a breakthrough advance in measuring the quality and dynamics of entrepreneurship ecosystems at a national and regional level that reflects the multifaceted nature of entrepreneurship. The last edition of the GEI report includes rankings of the 137 countries. In the following Table 2 is presented the GEI structure.

Tab. 2 – The framework of Global Entrepreneurship Index. Source: Global Entrepreneurship and Development Institute (2019)

GLOBAL ENTREPRENEURSHIP INDEX	Sub-indices	Pillars	Indicators	
	ATTITUDES SUB-INDEX	1. Opportunity perception	▪ Opportunity recognition	▪ Freedom
		2. Start-up skills	▪ Skill perception	▪ Education
		3. Risk acceptance	▪ Risk perception	▪ Country risk
4. Networking		▪ Know entrepreneurs	▪ Agglomeration	
5. Cultural support		▪ Career status	▪ Corruption	
ABILITIES SUB-INDEX	6. Opportunity start-up	▪ Opportunity motivation	▪ Governance	
	7. Technology absorption	▪ Technology level	▪ Technology absorption	
	8. Human capital	▪ Educational level	▪ Labour market	
	9. Competition	▪ Competitors	▪ Competitiveness	
ASPIRATION SUB-INDEX	10. Product innovation	▪ New product	▪ Tech transfer	
	11. Process innovation	▪ New technology	▪ Science	
	12. High growth	▪ Gazelle	▪ Finance and strategy	
	13. Internationalization	▪ Export	▪ Economic complexity	
	14. Risk Capital	▪ Informal investment	▪ Depth of capital market	

The GEI is composed of three building blocks or sub-indices (the 3As): entrepreneurial attitudes, entrepreneurial abilities, and entrepreneurial aspirations. These three sub-indices stand on 14 pillars, each of which contains an individual and an institutional variable that corresponds to the micro- and the macro-level aspects of entrepreneurship (together 28 indicators). A benchmarking principle (95th percentile score adjustment, normalization and arithmetic average) are applied in transformation of components. The overall GEI score is simply the average of the three sub-indices and ranges from 0 to 100, where 0 represents the worst enterprise environment and 100 means the best enterprise environment.

The analyses of enterprise environment within the EU (28) member states were performed on the basis of secondary data drawn from the databases and published in reports of the World Bank Group (2020) and the Global Entrepreneurship and Development Institute (2019).

## Method

According to Scoltock (1982), cluster analysis is a multidimensional statistical method used for classification of objects. It sorts units into groups (clusters) so that units belonging in the same group are more similar than objects from other groups. According to Halaskova (2018), the cluster analysis is sensitive to the occurrence of outliers and it sorts different objects into groups

with the highest degree of association between objects in the same group, and with a minimum degree of association in different groups. The aim is to achieve as much similarity within groups as possible and make the individual groups as different as possible. Bano and Khan (2018) states that clustering methods are based on determining the object similarities that are assigned into the same cluster. A significant part of these similarity measures is based on calculating the distances between the objects. Similarity of objects can be measured by different means, for example, by association measures, distance measures and correlation measures. As reported by Meloun, Militky and Hill (2017), the distance measures are the most widely used measures based on the representation of objects in space the coordinates. The most widely used distance measure is the Euclidean Distance (ED), expressed by the following equation:

$$ED_1(x_i, x_j) = \sqrt{\sum_{l=1}^m (x_{il} - x_{jl})^2} = \|x_i - x_j\| \quad (1)$$

where:

$m$  – number of variables,

$x_{il}$  –  $i$ th coordinate in dimension “ $m$ ”,

$x_{jl}$  –  $j$ th coordinate in dimension “ $k$ ”.

Each distance between objects must fulfil the following properties for any triplet of  $x, y$ , of the objects considered: (a) is nonnegative, i. e.  $d(x, y) \geq 0$ ; (b)  $d(x, y) = 0$  if  $x = y$ ; (c) is symmetrical, i.e.  $d(x, y) = d(y, x)$ ; and (d) the triangular inequality is met, i.e.  $d(x, y) + d(y, z) \geq d(x, z)$ .

When choosing a clustering method, the nature of the original data should be considered. Ward's hierarchical clustering method is included among the most common used, as it combines objects into groups so that the inter-cluster dispersion is as low as possible. Therefore, this method clearly distinguishes from all the others, because it uses a dispersion analysis so as to determine the distance between clusters, i.e. the minimum increase of the deviation squares sum from the cluster's average.

## 4 RESULTS

Identification of the enterprise environment is quite a complicated issue. However, many international institutions developed a complex measure tools for assessing the enterprise environment. Thus, in the following part of paper are presented two selected global multicriteria indices used for analysing enterprise conditions at the international level. The following Table 3 shows the basic outputs of descriptive statistics of the DBI and GEI.

Tab. 3 – Descriptive statistics of global multicriteria indices. Source: own research

Descriptive Statistics	Mean	Median	Standard deviation	Skewness	Kurtosis	Minimum	Maximum	Percentiles	
								25	75
<i>DBI (2010-2019)</i>	74.38	74.78	5.73	-0.22	-0.72	59.70	85.30	70.21	79.04
<i>GEI (2010-2019)</i>	52.48	49.60	13.47	0.17	-1.21	22.69	79.40	41.38	65.33

### Assessment of enterprise environment development using global multicriteria indices

The starting point of the research was to analyse the enterprise environment within the EU member states using selected global indices for the period 2010-2019. At first, the attention was focused on evaluating the DBI development (Figure 1).



Fig. 1 – The average DBI score of the EU member states over the years 2010-2019. Source: own research

The conditions of the business environment of the EU countries have improved in terms of the DBI assessment in the period under review. The average score achieved an increasing development trend, the values ranged from 59.70 to 85.30. The median reached the value of 74.78 and the standard deviation was quantified at the level of 5.73. When comparing countries with the EU average score, it was found that 16 countries achieved a value higher than the EU average, while 12 countries achieved a lower value. Denmark (84.47), United Kingdom (83.03) and Sweden (81.83) were included among the countries with the best conditions for doing business. On the contrary, to the countries with the worst business environment belonged Malta (63.80), Greece (65.38) and Luxembourg (67.95), what is a relatively unexpected result.

The next part of the research represents business environment assessment from the perspective of GEI (Figure 2). In this case, the analysis was performed within the EU countries for the period 2010-2019.



Fig. 2 – The average GEI score of the EU member states over the years 2010-2019. Source: own research

In the view of the GEI indicator, the entrepreneurship conditions in the EU have improved over the period analysed, but the development trend was unstable. The average score of the EU member states ranged from 22.69 to 79.40. The median reached the value of 49.60 and the standard deviation was quantified at the level of 13.47. A cross-country comparison revealed that 15 countries achieved the average score above the EU average. Based on the results, Denmark (75.12), Sweden (73.82) and United Kingdom (70.43) were indicated as the best-performing in creating business conditions, while the worst doing business environment was detected in the case of Croatia (34.83), Malta (36.35) and Romania (36.38).

## Categorization of the EU member states using global multicriteria indices

To find out the answer to the research question, the following part of the research was oriented on the categorization of the EU member states by applying cluster analysis. In order to detect, whether enterprise environment disparities among countries have reduced over the period analysed, the cluster analysis was realized separately in 2010 and 2019.

An essential condition for the cluster analysis is the non-correlation of the input data. The correlation between the selected indices reached the value of 0.38 (KMO test), so the cluster analysis could be employed. The input data were not standardized, as both indices are expressed through scores, thus eliminating any influence of the units. As mentioned in the methodological background, Ward's method of hierarchical clustering was applied. Moreover, the ED was used (mathematic formula number 1). The Figure 3 below shows the clusters of EU countries in the form of a dendrogram for 2010. When examining the dendrogram, there is valid that the greater the right-hand link (X-axis), it means that the country is less similar to the first cluster of countries. Thus, the resulting number of clusters is determined by the X-axis, which indicates the distance at which a particular country has joined the particular cluster. According to another statistical option, the number of clusters can be estimated using intra/inter clusters' variance of individual variables. In this paper, the final number of clusters was settled using dendrogram results.

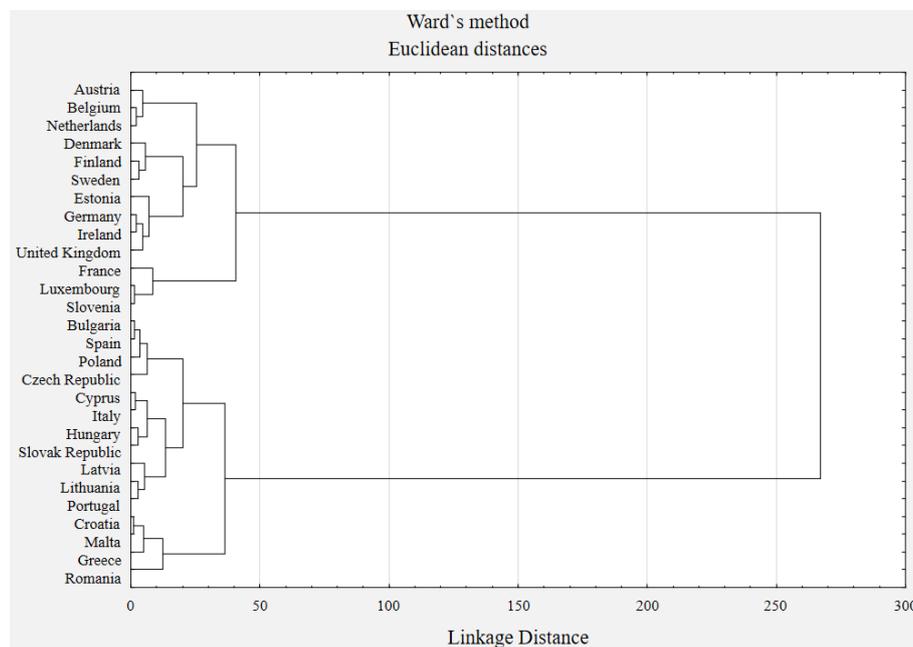


Fig. 3 – Dendrogram of the EU member states based on DBI and GEI (2010). Source: own research

Based on the research findings, four clusters of countries were identified in 2010 with regard to conditions for doing business, namely:

**Cluster 1:** "Advanced countries in doing business" – first cluster consists of 10 countries (Austria, Belgium, Netherlands, Denmark, Finland, Sweden, Estonia, Germany, Ireland and United Kingdom). This cluster of countries is characterized by the highest score within the both indices. Based on findings, it can be stated that above-mentioned countries belong to the EU leaders in creating suitable conditions for enterprise activities. It is knowledge that Nordic countries, as well as, Germany, Belgium, Netherland and United Kingdom are ranked among the Europe's most developed countries in business sector, and paper results confirmed this assumption.

**Cluster 2:** *"Above-average countries in doing business"* – the second cluster includes 3 countries (France, Luxembourg and Slovenia). This group of countries did not achieve any minimum or maximum score over the period analysed. An average score of the monitored indices within a given cluster recorded values above-average in comparison to the EU average. Based on the results, these countries can be labelled according to business-related factors as well-performing, however admitting that these countries still have some limits in comparison with the most advanced EU countries.

**Cluster 3:** *"Below-average countries in doing business"* – third cluster of countries comprise of 11 countries (Bulgaria, Spain, Poland, Czech Republic, Cyprus, Italy, Hungary, Slovak Republic, Latvia, Lithuania, Portugal). This cluster of countries (similar to Cluster 2) did not reach any minimum or maximum scores within the selected indices. Based on the findings for 2010, it can be stated that above-mentioned countries achieved below-average scores in doing business in comparison to the EU average. Results revealed that these countries lag behind the most developed ones, and many business-related problems need to be solved.

**Cluster 4:** *"Business limited countries"* – the last cluster includes 4 countries (Croatia, Malta, Greece, Romania). This group of countries achieved minimum scores within both selected indices. It means that these countries were among the weakest ones in relation to business conditions. In this context, the business limits should be eliminated by international, as well as, national interventions as soon as possible.

Furthermore, based on the results of Distance matrix and the Amalgamation schedule for 2010, we have revealed several other findings. Among 28 analysed countries, Croatia and Malta were revealed as two the most similar countries in accord to business-related factors, as the ED between countries recorded the lowest value (1.17). On the other hand, in line of ED results, the countries reaching the most different scores were Romania and Denmark (ED at the level of 49.9). Using the matrix and schedule it can be determined which countries are similar to each other and which, in turn, show the greatest differences. These findings thus enable not only to compare the degree of business prosperity of countries, but also to assist in creating targeted business strategies for a particular country within the EU in order to eliminate existing disparities.

In the connection to previous analysis, the following section focuses on the categorization of the EU member states. However, in this case, the analysis was realized for year 2019. At first, it was necessary to confirm the non-correlation of the input data. The correlation among selected indices was confirmed at value of 0.35. That's suggesting that it is appropriate to apply cluster analysis to the data. The following Figure 4 provided in the form of dendrogram shows results of cluster analysis for the year 2019.

Based on the dendrogram findings, from the point of view doing business environment were identified four clusters of countries in 2019, namely:

**Cluster 1:** *"Advanced countries in doing business"* – the first cluster consists of 9 countries (Austria, Germany, France, Finland, Ireland, Sweden, Netherlands, Denmark and United Kingdom). Above-mentioned countries obtained the highest value in both global indices. Thus, the observed results reveal that the business environment in these countries belong to the best one within the EU. In this backdrop, it was confirmed an assumption that Nordic countries, together with the United Kingdom, Germany, Austria and France belong the most advanced countries in Europe, with a highly developed level of economic and policy conditions for doing business.

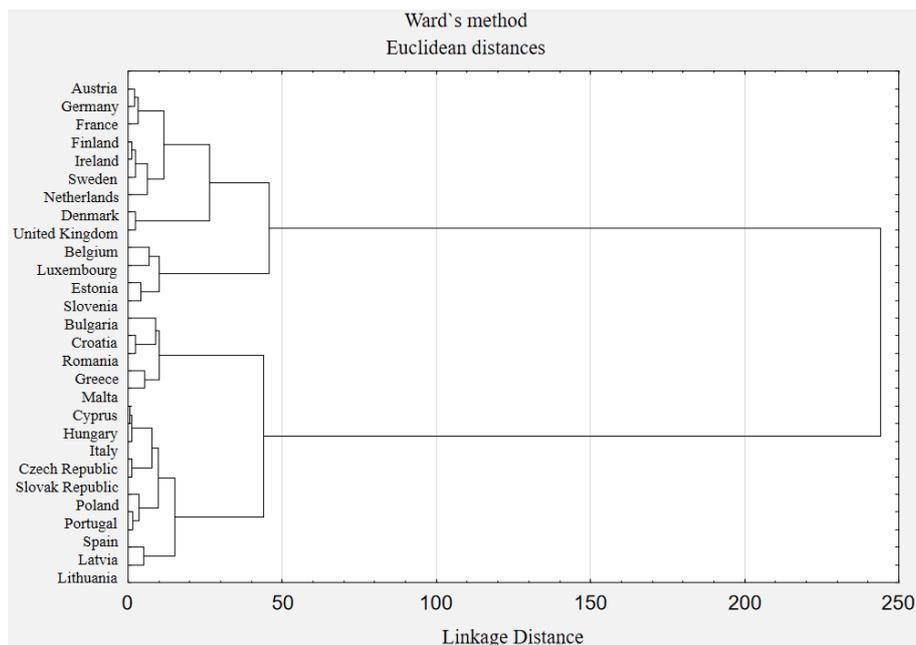


Fig. 4 – Dendrogram of the EU member states based on DBI and GEI (2019). Source: own research

**Cluster 2:** *"Above-average countries in doing business"* – the second cluster includes 4 countries (Belgium, Luxembourg, Estonia and Slovenia). Neither any minimum, nor maximum score were identified within this cluster. The average score of countries within this cluster obtained higher values than the EU average. When compared this cluster to the EU average for 2019, it can be concluded that the countries achieved satisfactory prosperity within the business environment, however it was confirmed some limits that obstructed them to become the best EU countries from business perspective.

**Cluster 3:** *"Below-average countries in doing business"* – the third cluster consists of 10 countries (Cyprus, Hungary, Italy, Czech Republic, Slovak Republic, Poland, Portugal, Spain, Latvia and Lithuania). The created cluster (similar to Cluster 2) did not achieve any minimum or maximum values. Average score of indices within this group of countries were indicated below the EU average. On the basis of the results for 2019, it can be stated that these countries have lagged behind the most advanced EU countries, and various specific business-related limits should be removed.

**Cluster 4:** *"Business limited countries"* – the last cluster includes 5 countries (Bulgaria, Croatia, Romania, Greece and Malta). This group of countries can be identified as the worst-performing in terms of business environment, as the countries belonging to this cluster acquired average minimum scores according to both indices selected. On the basis of findings for 2019, it can be concluded that business conditions should be improved immediately by applying effective strategies at national, as well as, international level.

Furthermore, based on findings, presented by the Distance matrix and the Amalgamation schedule for 2019, the several facts were revealed. According to the lowest ED value (at the level of 0.60), Cyprus and Hungary were quantified as the most similar countries within the EU. On the contrary, the highest score range between countries was revealed in the case of Denmark and Bulgaria. This finding was confirmed by the highest value of ED (51.0). Based on the matrix and schedule results it can be compared the level of business prosperity, as well as, suggested targeted business development strategies for individual EU member states.

Based on the above results, it can be concluded that EDs between European countries are significantly lower in 2019 compared to 2010. Thus, these results indicate a reduction of

disparities among countries from the point of view assessment of conditions for entrepreneurship. Moreover, the overall scores of both indices achieved the positive development trend within the EU member states under the period review. These findings lead to the conclusion, that the EU strategies, as well as, national interventions are implemented successfully within the individual economies. In this backdrop, the answer to RQ can be formulated positively. For the last 10 years, business environment improved significantly in the EU, however, it still needed to eliminate some barriers. However, in the case of three countries (Belgium, Bulgaria, Estonia), business conditions worsen over the years 2010-2019. On the other hand, France improved its overall position and ranked among the European leaders in 2019.

## **5 DISCUSSION**

In our previous studies, we analysed the development of countries' competitiveness from different perspectives based on several other multicriteria index (Kiselakova et al., 2019). In this case we decided to focus on business environment assessment. It is obvious, that enterprise sector contributes directly to aggregate economic growth in the Europe. Nowadays, Europe faces a great challenges and ICT sector, as well as, growing role of knowledge contributes to positive economic development (Gallo et al., 2019). According to Stefko et al. (2019), there is no doubt that innovation is synonymous with success. In the area of business sector is crucial to take the advantage of all opportunities to strengthen customer relationships. According to Hussain and Haque (2016), stimulating economic growth and improving Europe's competitiveness by removing barriers related to entrepreneurship, lead to creating an environment conducive to investment and innovation. Therefore, the proper combination of institutional economic conditions and entrepreneurial activities is the fundamental base for the successful growth of the economy. As reported by Bazo et al. (2019), in recent years, unstable business performance has been reflected. Many external business environment subsidence tends to decline, while macroeconomic variables grow (employment, value added, R&D expenditures, revenues from corporate taxes). Authors concluded that the companies have adapted, but the process of improving the business environment become much more expensive over time. Głodowska (2017) pointed to interrelations between economic growth and business environment within the European Union countries. To verify the interdependencies between variables, a multivariate regression and backward stepwise regression were applied. In this regard, significantly impact of business performance on the economic development was confirmed. As stated by Canare, Francisco and Morales (2019), to promote business growth, many countries have implemented reforms aimed at making it easier and less costly to do business. The research findings proved that the overall ease and cost of doing business is indeed associated with business creation significantly. In particular, lower cost of doing business was found to be a much stronger predictor of business creation than ease of doing business. The issue of business environment assessment was researched also by Belas et al. (2019). The aim of their study was to identify the most important factors that shape the quality of the business environment. As the part of empirical research, authors approached over 9,400 companies in the SMEs segment. The research findings showed that the biggest negative impact on the quality of the SMEs business environment is due to factors closely related to the public sector. In accordance with the above-mentioned studies, it can be concluded that business environment conditions are determined by many economic, political and social factors. We agree with authors' opinions that it's almost impossible to formulate a complex of certain determinants influencing the business sector. Nevertheless, the categorization of the EU member states can assist to further formulate strategies for specific clusters by policymakers.

## 6 CONCLUSION

The issue of sustainable value of countries, business market conditions, competitive features, as well as, success factors are examined in all economic areas (Stefko et al., 2017). In order to support the creation of targeted plans and strategies in Europe in relation to business environment, the presented paper categorizes the EU countries into specific clusters.

The main aim of the paper is to evaluate the development of the business environment of the EU using two selected international multicriteria indices (DBI and GEI). Analysis was performed over the years 2010-2019. Furthermore, in order to categorize the EU member countries into clusters, a multidimensional classification of countries was applied. The purpose was to find out whether entrepreneurship disparities have reduced over the period analysed.

Development analysis within the Europe countries using two selected global multicriteria indices (DBI and GEI) revealed that conditions for doing business have improved in the years under review. Within the EU member countries, the DBI reached score 74.38 (on average) over the period 2010-2019. From the point of the GEI assessment, an average score of the EU achieved the level of 52.48. Considering both global indices, to the best-performing countries belonged Denmark, United Kingdom and Sweden. On the other side, countries such Malta, Romania and Greece were indicated as the worst-performing in creating conditions for entrepreneurship. Decreasing values of EDs confirmed that enterprise environment disparities among the EU member states have been reduced gradually over the period analysed.

Despite of these positive findings, the business environment of particular EU member states is not perfect. In this regard, countries included to 3rd cluster (Below-average countries in doing business) and 4th cluster (Business limited countries) should solve problems related to the support of business development as soon as possible. Utilizing statistical methods to categorize countries in the area of business conditions help to addresses a research gap.

In conclusion, it is necessary to state research limitations and future research plans. The validity of this paper for individual countries is debatable, as authors do not provide specific factors influencing business environment. For this reason, the deeper analysis of the individual pillars and indicators within the DBI and GEI might be performed. So, further research might focus on the detection of determinants improving or decreasing the countries positions in ranking of global indices. From the point of view of policymakers, the research results may be perceived as general and non-useful. For the future research, specific recommendations for created clusters should be provided. Besides of, it is necessary to emphasize that the findings depend on the researcher's opinion to the selection of indices, time period and cluster' method. In order to obtain provable results, more indices should be involved in the analysis.

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# **BUSINESS MODELS FOR SUSTAINABILITY AND SMES' SUSTAINABILITY PERFORMANCE: A CONCEPTUAL FRAMEWORK**

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## **Abstract**

This paper explores the concept of business models for sustainability (BMfS). The emerging literature on sustainability points to it as a means by which SMEs may attain sustainability. The aim of this paper is to determine using extant literature the role of BMfS as well as its relationship with SME's sustainability performance. Using the literature review approach, 39 scientific papers from good journals are examined. It is determined that 1. It is useful in achieving SME sustainability performance, 2. That theoretically, there is a relationship between the two constructs. To determine the specific conditions under which the relationship exists, two additional variables are introduced. These are market readiness as a moderator and business case drivers as mediators. The market readiness variable specifically highlights the important role that the market plays in accepting sustainability models being implemented by firms. The purpose of this is to determine if the market is ready to accommodate such changes and the costs associated with them. The business case drivers are also meant to motivate firms to proactively manage their sustainability efforts. These variables are put together to develop a conceptual framework and some propositions that would be tested empirically by the authors to determine its soundness. The paper finally concludes with some implications, suggestions for future studies, and limitations of the current work.

*Keywords: business models for sustainable, SMEs' sustainability performance, market readiness, business case drivers, challenges of sustainability*

## **1 INTRODUCTION**

The concept of sustainability has been around for some three decades now (Brundtland Report, 1987) and at this stage, there is no argument about its relevance or better still its necessity to the very existence of life (Lesk, Rowhani, & Ramankutty, 2016; Tardy, 2009). Some scholars in this field hold the view that the neglect of this subject matter at the micro-level, has dire consequences for firms (Haugh & Talwar, 2010) and probably represents an "existential threat" to the earth and all that resides in it. For this matter, academics, institutions, business organizations, and the world at large are giving it a lot of attention. Proposing theories, to help explain the concept (Enders & Remig, 2015; Markard, Raven, & Truffer, 2012; Walsh, Böhme, & Wamsler, 2020); suggesting indicators to measure it (Cladera, Desha, & Dawes, 2019; Hojnik, Biloslava, Cicero, & Cagnina, 2020; Lee, Che-Ha, & Alwi, 2020) providing strategies, models, and practices to fully implement it (Broccardo & Zicari, 2020; Daub & Hasler, 2020; Lukede-Freud, 2019) and identifying research gaps to encourage further studies (Terán-Yépez, Marín-Carrillo, del Pilar Casado-Belmonte, & de las Mercedes Capobianco-Uriarte, 2019; Walker et al, 2014).

One of the ways by which the world has sought to attain sustainability is through entrepreneurship (De Clercq & Voronov 2011; Hall, Daneke, & Lenox, 2010). Sustainable entrepreneurship is essentially viewed by its scholars as entrepreneurs' (enterprise's) ability to balance set goals in the area of economic (which is a natural consequence of most enterprises), social and environment (Belz & Binder, 2015; Cohen & Winn, 2007; Dean & McMullen, 2007).

Shepherd and Pazelt (2011) p.142 succinctly define it as: “*Sustainable entrepreneurship is focused on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society*”. This definition combines two divergent views: 1. The pursuit of business opportunities for the attainment of business goals (future products, processes, and services for profits); 2. The pursuit of individual and social goals (for non-profits). This definition captures the basic essence of sustainable entrepreneurship. This oxymoronic alliance has interestingly yielded some positive results (Boachie-Mensah & Owusu, 2015) and as such there have been calls to further expand on its workings so that more benefits could perhaps be to achieved from it (Collins & Saliba 2020).

This paper follows the path of conceptualizing models to fully appreciate sustainability and all its other related constructs. Though a relatively young approach in sustainable entrepreneurship literature, business models for sustainability are gaining some attention and increasingly becoming quite popular. Abdelkafir and Täuscher, (2015) and Lüdeke-Freund and Dembek, (2017) argue for this approach by claiming that sustainability can only be attained if firms change their “entire business logic.” This position is a more logical approach to sustainability as the mere change of products, processes, and services even in the quest to attain both economic and non-economic goals for businesses and the society (Shepherd & Pazelt, 2011) is inadequate. A paradigm shift in the thinking of the business is what is needed to achieve this all-important goal of the modern enterprise.

This work serves as a prelude to a future empirical work on Business Models for Sustainability (BMfS) and SME sustainability performance to propose a model of how sustainable entrepreneurship could work in a developing economy setting. The current work, however, aims at the following: a discussion on the relationship between BMfS and SME sustainability performance; development of a conceptual framework and propositions and definition of the major constructs that are related to sustainability but have not received much attention in the sustainability literature. The paper then concludes with the implications and suggestions for future research. The paper uses the literature review approach to further the discussion.

## **2 METHODOLOGY**

A literature search was done to identify and select appropriate and relevant literature for the current work. The primary databases that were originally used were: WoS and Scopus. These provided the majority of the literature that was used for the work. However, in the case of some relevant and important literature that were identified in the list of references of the selected papers, the first author had to rely on google scholar for them. It must also be indicated that access to literature on WoS was quite limited so even though, it was a primary tool, much of the literature ended up being selected from Scopus (provided it was in English) which gave access to all the literature from the search results.

The literature gathered from the original search from the three databases totalled about 200 papers based on the search words: sustainability, sustainable entrepreneurship, entrepreneurship, sustainable marketing, green marketing, sustainable practices, dimensions of sustainability, sustainability performance, indicators of sustainability, theories of sustainability. These search words were used to help the authors to appreciate the concept of sustainability and how it has even been applied in other fields apart from entrepreneurship. The search resulted in several thousands of papers however, after a careful selection process, about 200 papers were picked to create a personal database for the authors.

Also, regarding the new constructs, a literature search from Scopus was done. This produced the following: market readiness (5); BMfS (8), and business case drivers (5), from these the relevant constructs, were discussed. These results indicate that there is a huge literature gap in the sustainability literature relating to these constructs. For the current work, a total of 39 articles were used.

### **3 LITERATURE REVIEW**

The extant literature provides cues no the development of sustainable entrepreneurship; an assessment of which would throw light on the most relevant variables related to the subject and how other researchers have addressed them. The paper next focuses on some of these major variables.

#### **BMfS and SME's sustainability performance**

Attaining sustainability has become a noble business goal that most firms attempt to achieve. This is not because, it is the easiest or the most profitable, but rather it is being demanded by relevant stakeholders who wield both power and interest though in varying degrees. To satisfy this demand, business models for sustainability have been suggested by some researchers. It is viewed as a means of creating value not just for customers and the firm but also for all other stakeholders (Collins, & Saliba, 2020). Business models according to Langley et al., (2020) is actually how the business operates. Hence, going by this definition, an existing business would have to undergo a total overhaul of its business goals, activities, operations, processes, and programs to attain sustainability. Such firms would have to follow the “unfreeze-change-refreeze” approach as suggested by Lewin, (1947) in Hussain, Lei, Akram, T., Haider, Hussain, & Ali, (2018). On the other hand, a new enterprise would have to begin by creating a business geared toward attaining sustainability. The whole point of BMfS is that enterprises seeking to achieve sustainability would be better off incorporating it into the very fabric of that organization thereby using the systems approach (Forrester, 2013).

The success of the BMfS approach in attaining sustainability is still in its infantile stage since there is a lot more work to be done on the conceptualization of the construct (Stubbs & Cocklin, 2008). There is, however, enough information in the current literature on how firms can adopt the idea in their quest to attain sustainability. These contributions to the BMfS theory suggest that it may be the logical approach when working towards sustainability especially since there are indicators that serve as measurements for the construct. In this regard, other researchers should work at expanding the boundaries of knowledge on BMfS to put in additional meaning to these measures so that they can be properly understood.

Empirical work on sustainable business models (BMfS) was conducted at Bark House, the study found out that the firm was implementing sustainability practices by working with stakeholders, changing market perceptions and behavior, and refining its core operations. The conclusion from the study was that the firm was reaping economic benefits through customer loyalty and higher returns even during economic recessions (Collins & Saliba, 2020). This study gives evidence of the success of BMfS, however, relying on a single case study in making such a conclusion is not appropriate. It is, therefore, important for other studies to be considered in different industries and locations and using different sample sizes to determine the veracity of the claims of the BMfS concept. This is one of the goals of the future empirical study on the use of BMfS by SMEs in attaining sustainability.

## **Business Case Drivers and sustainability**

Business enterprises have traditionally been founded for the sole purpose of making profits. The call for sustainability should only be seen as additional responsibility for the enterprises. The challenge is that the additional responsibility imposed by sustainability i.e. social and environmental “competes” with the economic pursuits of the enterprise (Wagner, 2007). Current studies on the economic benefits of sustainability have not been very conclusive and for most entrepreneurs, it may seem impractical. It is for this reason that researchers here insist that there should be business case drivers (Eden, 1994; van Marrewijk, 2003 p.102; Schaltegger, Lüdeke-Freund, & Hansen, 2012). According to them, this serves as a motivation to pursue sustainability initiatives.

In putting forth this argument, Schaltegger, et al., (2012) provide three conditions that these business case drivers should satisfy: contribute to the solution of societal or environmental problems; create a positive business effect and be created by a certain management activity...intended for societal environmental, and economic benefits. These drivers exert a mediational influence on the relationship between sustainable initiatives by the firm and its consequence i.e. sustainable performance (Schaltegger et al., 2012; Abdelkafir & Täuscher, 2015). The influence of business case drivers on economic performance is well known both theoretically and empirically, however, empirical works on its mediating role are probably non-existent. This is yet another goal for a future empirical study.

## **Market (consumer) Readiness and SME sustainability performance**

For this work, market readiness is defined as the markets’ (consumers’) willingness to change and accept innovation that the firm is introducing to the market. This concept is one that has not gained a lot of attention though it is very relevant in the introduction of innovation and technology. The markets’ readiness to accept BMfS is a major determining factor in the sustainability performance of SMEs and as such its effect should be studied. The market (consumers) is an important stakeholder that plays a major role in various aspects of the firm’s activities (van der Werff, Thogersen, de Bruin, 2018) and so, its readiness is a relevant variable in firms’ sustainability.

In discussing readiness, Parasuraman (2000), explains it with optimism, innovation, discomfort, and insecurity. These determine the extent to which the market is willing to accept such innovation. The first two are positive indicators for readiness, whilst the last two are negative for readiness. Therefore, when the market is optimistic and innovation is present, then, the likelihood of readiness is high. On the other hand, when discomfort and insecurity are present, the market is likely to not be ready. The influence of market readiness would be an interesting phenomenon on the BMfS and sustainability framework. Needless, to say that readiness (in all its various forms) has been studied (Radenkovic, Bogdanovic, Despotovic-Zratic, Labus, & Lazarevic 2020; Zhang, Sun, Yang, & Wang, 2020; Kobos, Malczynski, La Tonya, Borns, & Klise, 2018) however, there is not a study on how market readiness affects sustainability. There is a gap in the literature on how these variables relate to each other. Hence, the future study would assess its relationship as a moderator variable.

## **Challenges in the implementation of sustainability**

Implementing sustainability is by no mean an easy strategic goal. Some initial empirical works give evidence of the challenges that entrepreneurs that follow this path have experienced. For example, Hoogendoorn, van der Zwan, & Thurik, (2019) found out that such entrepreneurs reported that it was discouraging and that they were more likely to face institutional barriers compared to other kinds of entrepreneurs. Also, it was claimed that these entrepreneurs had

specific challenges with how to deal with their unique stakeholders as such they highly entertained the fear of personal failure as compared to other kinds of entrepreneurs (Tura, Keränen, & Patala, 2019).

#### 4 DEVELOPMENT OF CONCEPTUAL FRAMEWORK AND PROPOSITIONS

Based on the summary literature review provided, a framework has been developed for a future empirical study. This is shown in Fig 1. Additionally, propositions have been developed.

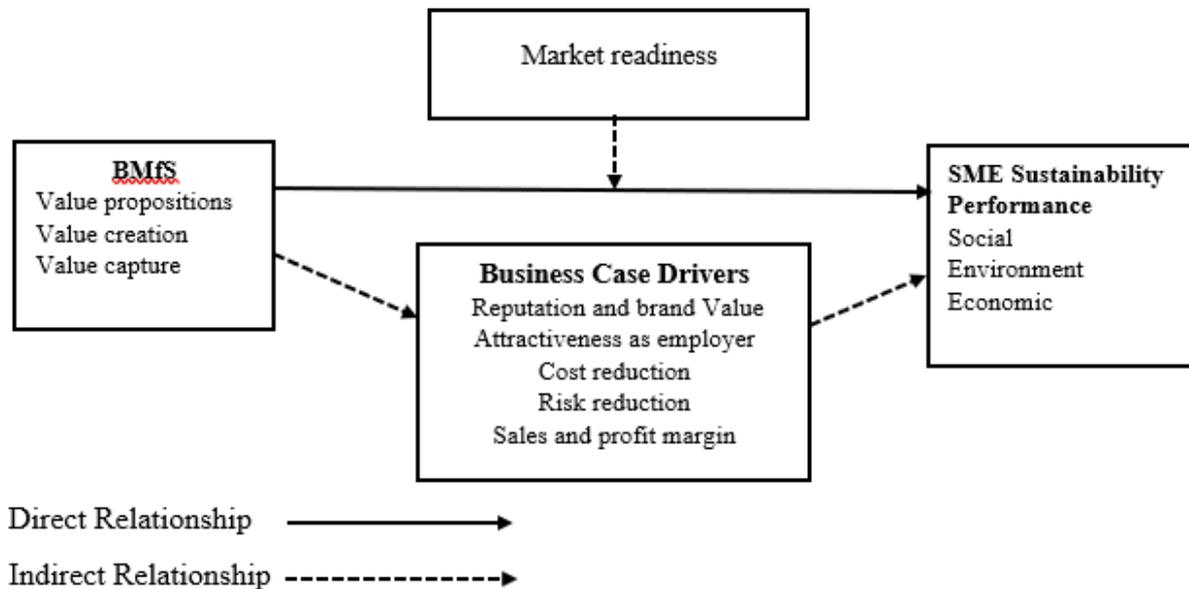


Fig. 1 – Conceptual framework. Source: own research

The conceptual framework illustrates the relationships among the variables of the study. There is a direct relationship between BMfS and SMEs’ sustainability performance. This relationship is then mediated by business case drivers hence, creating an indirect relationship. The framework also shows market readiness having, an indirect relationship on the BMfS and sustainability performance through a moderating mechanism.

##### Propositions based on literature review

P1: It is proposed that value propositions have a direct influence on SME sustainability performance.

P2: It is proposed that value creation influences SME sustainability performance.

P3: It is proposed that value capture influences SME sustainability.

P4: It is proposed that overall BMfS directly influences SME sustainability performance.

P5: It is proposed the market readiness has a moderating influence on the relationship between BMfS. and SME sustainability performance.

P6: It is proposed that reputation and brand value have a mediating effect on BMfS. and SME sustainability performance.

P7: It is proposed that attractiveness as an employer has a mediating effect on BMfS. and SME sustainability performance.

P8: It is proposed that cost reduction has a mediating effect on BMfS. and SME sustainability performance.

P9: It is proposed that risk reduction has a mediating effect on BMfS. and SME sustainability performance.

P10: It is proposed that sales and profit margin have a mediating effect on BMfS. and SME sustainability performance.

## **5 IMPLICATIONS OF THE STUDY**

The literature review has thrown further light on some major constructs that are related to sustainability. This has provided current insights on how these constructs function in terms of SMEs' sustainability performance. Additionally, some propositions have established based on the relationships between the constructs and SMEs' sustainability performance. Finally, a major outcome of this work is the development of the conceptual framework which is a model that other researchers can use as a basis for their future work.

Practically, the scope of this research would offer knowledge to SMEs and other industry players on how they can invest in and implement sustainability since it has become relevant to normal business operations. Of course, this does not suggest that all entrepreneurs can fully achieve this in one breadth; they are obvious challenges, and entrepreneurs and their businesses are at different levels of growth having to deal with different sets of priorities. Therefore, it is suggested that there should be a gradual introduction of these goals and (probably) in varying combinations until the enterprise is in the position to fully implement them. The aim of sustainable entrepreneurship, however, should be geared toward the full inclusion of such goals in the enterprise's strategic goals so that as have already been identified a better safer world can be created for both humans, other living things, and enterprises as well. It is expected that by doing this these firms would be able to reap the benefits associated with sustainable performance.

## **6 SUGGESTIONS FOR FUTURE RESEARCH**

The paper has proposed a conceptual model (figure 1) showing the relationship among BMfS, market readiness, business case drivers, and SME sustainability performance. The entire model is yet to be empirically tested, researchers in this field can take advantage of this and test it.

Researchers can use this work to further explore existing literature on the subject by including additional theories and using other approaches (methodologies) other than what has been used in the current work. This would elaborate and further extend the boundary of knowledge on the subject.

There are other constructs that are related to sustainability which have not been discussed in the current work, researchers can explore those other constructs that have been indicated in the existing literature.

## **7 LIMITATIONS OF THE PAPER**

The major limitation of this review is that not all papers could be accessed from the databases indicated. 1. Due to restrictions, access to some of the papers was not possible. Those papers, therefore, could not be part of the discussion. 2. Also, only articles in English could be included in the literature reviews. Other high-quality works that are not in the English language could not be included due to obvious reasons. These limitations could affect some of the conclusions

that have been made in the work. However, the conclusions that have been made are sound and based on the literature that the authors had access to.

## 8 CONCLUSION

This paper has delved into a new area in sustainable entrepreneurship. It has introduced a framework that incorporates both a mediator and a moderator variable. The purpose of this approach is to enable researchers and practitioners alike to appreciate the exact conditions under which, investments in sustainability support SME sustainability performance. The paper has made some propositions in the light of relevant and current literature and it is hoped that this would result in further studies so that the ultimate goals of sustainable entrepreneurship are achieved.

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# IMPACT OF COVID-19 ON TOURISM EMPLOYMENT: THE CASE OF SLOVAK REPUBLIC

*Martina Özoğlu*

## **Abstract**

In last years, tourism industry became one of the most dynamic sectors in world economy with multiple times higher job growth than in other sectors of the EU economy. However, since 2020, the whole world is fighting the invisible enemy called COVID-19, which brought to the world and Slovak economy many obstacles with the significant impact on tourism industry. Countries release extensive protective measures towards stabilizing of the national economies. The impact is country-to-country different. Slovakia started to fight COVID-19 in its early beginning, which helped to minimize the spread, however, the economic impact has become larger. The main focus of this paper is engaged to the estimation of the impact of COVID-19 on employment in accommodation services in Slovakia. Forecasting model is provided based on econometric program GRET. We forecasted values of number of jobs in accommodation services for the second and the third quarter of 2020 based on real data of number of nights spent in accommodation establishments and turnover in accommodation services. The data are presented in graphical and written form. The main result of the paper claims that the spread of COVID-19 in Slovak republic has a negative impact on employment in accommodation services.

*Keywords: COVID-19, tourism employment, prediction, accommodation services*

## **1 INTRODUCTION**

At the day 15<sup>th</sup> March 2020 there has been announced state of emergency in Slovak Republic, due to the spread of the novel COVID – 19. Virus has been spreading from November 2019 until today all over the world from Wu-han in China through South-East Asia, Australia, Middle Asia, Europe to North and South America. Countries are fighting the virus by peculiar protective measures, actions and decisions on country level. In Slovakia, the first case was recorded on 6<sup>th</sup> March 2020. From that moment Slovakia took immediate actions for prevention of the spread through tough the country, which caused very slight course of the sickness however, unfortunately, it caused higher effect on the economy and its decline. Necessary protective measures and regulations reduced public life and social contacts and almost completely cut down travelling and tourism activities. Restriction affected development of travel and tourism sector from the early phases. Early restrictions announced by the Slovak government are mentioned below (ÚVZ SR, 2020): (a) closure of all three international airports, (b) mandatory 14-day quarantine for people with permanent or temporary residence in the Slovak Republic who return from abroad, (c) the introduction of temporary border controls with all neighbouring countries, (d) restriction of international and domestic train and bus transport, (e) closure of bars, leisure facilities and areas (ski resorts, wellness centres, fitness centres, amusement parks and water parks), (f) closure of social and cultural facilities, (g) closure of shopping centres, and (h) hotels and restaurants may be open, with the restriction to organize mass events of a sporting, cultural, social or other nature.

From middle March 2020 there were almost impossible to perform tourism activities, starting with the first condition, which is travelling from point A to point B due to the government restrictions and limited movement within the country. Another barrier related to tourism

activities were closed accommodation establishments. Most of them preferred to stay closed during the state of emergency due to the operation costs, which were expected to be higher than the profit. This specific situation lasted from 15<sup>th</sup> March until the end of state of emergency 13<sup>th</sup> June 2020. Meanwhile, some of the accommodation establishment started to re-open their businesses (Ayinde, 2020), however, most of them served mainly for quarantine purposes.

This situation caused fatal consequences for many accommodation facilities in Slovakia, mainly small and medium sized establishments, or caused major problems for their business' survival. Accommodation facilities lost their revenues due to the extraordinary situation. From the other hand, closed borders and restraint of Slovak residents on traveling and tourism activities raised concerns about the development of consumer behaviour in the upcoming period in the field of travel and tourism, namely in accommodation services.

The first economic measures for preventing an unfavourable economic situation coming from the Slovak government for the business environment were following (TASR, 2020): (a) The state shall reimburse 80 percent of the employee's salary to companies whose operations are compulsory closed. (b) In April, within a decrease in sales of more than 20%, the government will contribute 180 EUR to the salary of an employee or self-employed person, with a decrease of 40 percent 300 EUR, with a decrease of 60 percent 42 EUR and with a decrease of 80 percent 540 EUR. (c) Provision of bank guarantees of EUR 500 million per month. (d) For quarantined employees and parents with nursing benefit, 55% of their gross salary will be paid. (e) Deferral of payment of employer on behalf of the employer in the event of a decrease in sales of more than 40%. (f) Deferment of income tax advances in the event of a decrease in sales by more than 40%. (g) Possibility to offset a loss that has not yet been claimed since 2014 inclusive.

Many of these actions were introduced particularly to prevent the reduction of unemployment, although they will not ultimately prevent of job losses. How did these measures help in the first months of state of emergency and what is the forecast for the next quarters in 2020?

During this uncertain social and economic situation, it is necessary to predict the customer behaviour and market situation, so the demand and supply side of the market can be prepared for the upcoming months.

## **2 THEORETICAL BACKGROUND**

One of the main economic contribution of the tourism to the national economy it is its capability to create new jobs (Frechtling, 2013; Dwyer et. al, 2010; Malviya, 2005; Riley et al., 2002; Hayward, 2000). Sustainable importance of tourism employment and development mentions Markovičová & Michálková (2019), Manzoor et al. (2019), Baum (2018), Baum et al. (2016), Shakeela et al. (2011), Tosun (2001), Burns (1993). Fodranová et al. (2015) classifies tourism employment within the three key indicators of the economic value of tourism as part of social value. Kusugal (2014) believes that tourism may bring solution for many socio-economic issues such as unemployment or underdevelopment. Skilled and experienced workers in tourism industry are the significant element of tourism development (Aynalem et al., 2016).

According to WTTC (2020) travel and tourism sector contributes yearly to the global GDP by over 10% and averagely in past five years generates one out of five new jobs (WTTC, 2019). Due to the COVID-19, a possible loss of employment is estimated in travel and tourism sector with a loss of more than 100 million jobs worldwide, with over 30% loss in March 2020 (WTTC, 2020). Accommodation sector contributes to worldwide employment by 144 million of workers, which work mainly in micro, small and medium sized enterprises (ILO, 2020a). The massive impact of COVID-19 may be mainly noticeable in businesses with 2-9 employees and its workers (ILO, 2020a). ILO (2020b) states that more than 50 million businesses

worldwide are facing economic difficulties with major impacts on employment in terms of devastating reductions in working time, potential job losses and growing decent work challenges. In the first quarter of 2020 there was a decrease in working hours by 3,4% in Europe, which represents loss of 11 million of FTE jobs (ILO, 2020b).

According to many institutions engaged to tourism such as OECD, UNWTO, Eurostat, tourism role in worldwide economy is increasing year by year. “*Job growth in tourism has been over three times as high as the overall job growth of the EU economy since 2000* (CEDEFOP, 2020).” However, nowadays this sector faces uncertain future and the post pandemic impact may bring significant changes to visitors’ habits and business operations, which may cause a struggle for upcoming years (CEDEFOP, 2020). Based on CEDEFOP’s analysis (CEDEFOP, 2020), which is based on two high-risk factors: 1. importance of international arrivals for a country’s tourism sector, and 2. share of small enterprises in the tourism employment sector, Slovakia belongs to countries with lower expected job loss risk in tourism sector. On the other hand, according to AHRS - Slovak Hotels and Restaurant Association (OECD, 2020) there is estimated a risk of loss of 68,000 jobs in accommodation and catering services, which represents decrease by 63% of current jobs in this sector. AHRS also expects a decrease in number of domestic and incoming visitors by 50%, of which 60% by incoming tourism due to the lockdown, border closure and followingly, government order to close hotels and restaurants, which caused that during this period 90% of accommodation and catering services, had no income (OECD, 2020).

According to data from Statistical Office of the Slovak republic (SOSR, 2020a), comparing the data of the first quarter of 2020 to the same period in previous year, the number of total visitors decreased by 14%, of which incoming tourists decreased by 15% and domestic visitors by 13%. The number of total nights spent decreased by 11%. The turnover of accommodation services decreased averagely by 13% (SOSR, 2020b). The data for the first quarter was affected mainly by the March 2020 declines. According to Eurostat (2020a) the number of nights spent at accommodation establishment decreased by 56% in March comparing to the same period of previous year, of which incoming visitors’ nights spent decreased by over 61%. In April 2020 there is a recorded decrease by 97% to year-to-year comparison. Turnover in accommodation establishments decreased in March 2020 in year-to-year comparison by 50%, in April by 84% and in May by 81% (SOSR, 2020b).

A strong domestic tourism may help a country overcome economic shocks and demand fluctuations that may occur when crises affect external source markets (WTTC, 2019), Accommodation services belongs to labour intensive sector, which directly contributes to employment by 6.9% in OECD countries (OECD, 2020). This sector provides volume of wide range jobs for highly skilled people and for low skilled workers. However, in the past, there was no expectation of the external crises with such a huge effect on movement and tourism. Tourism was, at the beginning of the year 2020, forecasted to increase by approximately 4% worldwide (UNWTO, 2020), however, current situation brings new realities and the businesses in tourism sector need to adapt and survive. The help for these businesses comes at the first place from national governments, which implemented policies to support tourism businesses in forms of suspension or subsidization of taxes, fees and social security contributions (ILO, 2020a).

In order to help accommodation industry there is a necessity to predict the development in the industry itself. Many predictions of development of the COVID-19 cases in different countries have been made (Ogundokun et al., 2020; Ayinde, 2020; Torrealba-Rodriguez et al., 2020), however, very important is to predict the development of the industries effected by the COVID-19 cases (Hang et al., 2020; Sobieralski, 2020). The recovery of tourism is influenced by

tourism behaviour (Kock et al., 2020; Qiu et al., 2020). From the social point of view, change of tourism behaviour may have three different scenarios (Zenker & Kock, 2020): 1. tourism attempt to support national economy by domestic travels, 2. tourists are afraid and they avoid the crowds and travel to less populated regions or do not travel at all, 3. tourists avoid the unknown things, countries, places, food, etc. In Slovakia, in the second quarter of 2020 there was 90% share of tourism nights spent related to domestic tourism (SOSRa, 2020), with the decline by 80% in total tourism night sent in accommodation establishments comparing to the second quarter in 2019. Therefore, the effect of Covid-19 and tourism behaviour is very clear. According to Hao et al. (2020) accommodation establishments should strive to retain employees during the pandemic, because the high-knowledge and experienced employees are one of the most valued assets for the accommodation establishment which may help to recover the businesses right after the pandemic is over.

Based on development of number of nights spent and development of turnover in accommodation establishment we can easily predict that the number of jobs in the sector of accommodation establishments may expect a decline. Number of nights spent is highly correlated to turnover in accommodation establishment, therefore, these two variables may influence the most of the internal development within the sector, mainly connected to tourism employment.

Tourism sector in Slovakia needs some stimulus to be reactivated again. What is the expected development in number of jobs in accommodation establishments based on official statistical data in Slovakia?

### **3 METHODOLOGY**

The aim of the paper is to quantify an estimated impact of COVID-19 on tourism employment in accommodation services in Slovak Republic. Numerical and graphical prediction of the development of tourism employment will be provided, which resulted from the consumer behaviour and business response to the state of emergency announced due to the COVID-19 spread worldwide and in Slovakia. We will evaluate maximal possible consequences of protective measures as a response to the state of emergency focusing on the development of tourism employment in Slovakia and its changes.

Based on data from the Statistical Office of the Slovak Republic and Eurostat, we will predict the development of tourism employment in the area of accommodation services in the second and third quarter of 2020.

Forecast of number of jobs will be provided based on official real data from the Statistical Office of the Slovak Republic and Eurostat data. The input data are quarterly aggregates of the number of overnight stays in accommodation establishments and turnover in accommodation services in time series starting from the first quarter of 2008 to the second quarter of 2020. The econometric model will forecast the development of employment, number of jobs, in accommodation services in the second and third quarter of 2020.

We will use an econometric program GRET, which will provide a forecast of employment indicators in accommodation services as a function of development of number of nights spent and turnover in accommodation establishments. First of all, according to formula 1, the basic linear regression model, the OLS regression model, will be examined. We will monitor the significance of model parameters, normality test and correlogram. Depending on the fulfilment of the model criterions, we will create a model that will allow us to predict number of jobs according to the selected parameters. If the autocorrelation errors are present we will use AR (1) model with Cochrane-Orcutt procedure for autoregressive errors according to formula 2.

Cochrane-Orcutt procedure is used for adjusting a linear model as a response to the presence of autocorrelation error in the data (Cochrane & Orcutt, 1949; Altman, 1992; Hoque, 2008; Song & Witt, 2012; Chatterjee & Simonoff, 2013; Kumar, 2020;).

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon \quad (1)$$

$$y_t - \rho y_{t-1} = \beta_0(1 - \rho) + \beta_1(x_t - \rho x_{t-1}) + \beta_2(x_t - \rho x_{t-1}) + \varepsilon_t \quad (2)$$

The input data are quarterly employment data in accommodation services from the first quarter of 2008 to the first quarter of 2020 (SOSR, 2020c) as a dependent variable. The data presents average number of employed persons and indices in the category of economic activities SK NACE. As we examine the impact of performance indicators on the development of employment indicators, we must consider postponing effects from quarter to quarter. Therefore, we need to recode employment as number of jobs to the T-1 period, due to the fact that impact of the number of overnight stays and revenues in the first quarter of year XY has an additional impact on employment in the following quarter of year XY. On the other hand, the interpretation of the forecast results in relation to employment is shifted by the period T+1.

Other input data used in the model, which were selected as the independent variables, are the number of overnight stays in accommodation establishment (Eurostat, 2020b) and the turnover in accommodation services (SOSR, 2020d). Input data consist of 48 quarterly data. In a model, the dependent variable is number of jobs in accommodation establishments. Independent variables are the number of overnight stays in accommodation establishments and the turnover in accommodation services. The turnover is obtained from the monthly statistical survey of enterprises with 20 and more employees and for selected enterprises with 0-19 employees and also for selected persons registered in the trade register and natural persons running business according to other than the Trade law (SOSRd, 2020). The number of overnight stays in accommodation establishments is obtained from Eurostat database (Eurostat, 2020b). Therefore, the whole scope of number of jobs in accommodation establishment will be forecasted.

## 4 RESULTS AND DISCUSSION

According to the methodology, we provided the econometric prediction model based on real data from official statistics. For the prediction of the number of jobs in third quarter of 2020, it was necessary to provide estimations of a turnover in accommodation services. OLS regression model occurred autocorrelation errors, therefore, AR (1) regression model with the Cochrane-Orcutt procedure is used to eliminate the errors. Based on official data, we provided the modelling and prediction of the employment data, number of jobs in accommodation establishments for the second and third quarter of 2020. The results of the model are presented in following Figure 1 and Figure 2 and Table 1.

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Model 1: Cochrane-Orcutt, using observations 2008:2-2019:4 (T = 47)
Dependent variable: employment
rho = 0,96606

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                coefficient      std. error    t-ratio    p-value
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const          10502,1           1395,54      7,525      1,96e-09 ***
turnover       2,32072e-05           6,78669e-06  3,420      0,0014 ***
nightsspent   -0,000272460           5,06700e-05 -5,377      2,75e-06 ***

Statistics based on the rho-differenced data:

Sum squared resid    3606082    S.E. of regression    286,2803
R-squared            0,934861    Adjusted R-squared    0,931900
F(2, 44)             14,97675    P-value (F)           0,000011
rho                  0,218449    Durbin-Watson         1,524409

Statistics based on the original data:

Mean dependent var    11364,38    S.D. dependent var    1095,907

Test for normality of residual -
Null hypothesis: error is normally distributed
Test statistic: Chi-square(2) = 7,21094
with p-value = 0,0271747

Test for ARCH of order 1 -
Null hypothesis: no ARCH effect is present
Test statistic: LM = 0,717399
with p-value = P(Chi-square(1) > 0,717399) = 0,396998

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Fig. 1 – Summary statistics for Cochrane-Orcutt model, n=47. Source: own processing in GTREL, data available from Eurostat (2020b), SOSR (2020c), SOSR (2020d)

To assess the quality of the model, we monitored the result statistics for parameters and the results of the, the Residual normality test and the LM test for monitoring autocorrelation in the monitored model. All tests were negative and we can say that 93% of the data is explained by our model. According to the presented model, we can assume that the number of jobs are highly dependent on the development of turnover and visitors' nights spent.

Tab. 1 – Actual and forecasted values of number of jobs in accommodation services 1q2019-3q2020. Source: own processing, data available from Eurostat (2020b), SOSR (2020c), SOSR (2020d)

	1q2019	2q2019	3q2019	4q2019	1q2020	2q2020	3q2020
number of jobs	13,381	14,055	14,603	14,047	13,663	undefined	undefined
forecasted value	12,410	13,558	14,252	14,393	14,082	13,224	12,106

Forecasted model shows us possible decline in the second quarter of 2020 by less than -6% and in third quarter by -17% comparing to previous period in the last year. Graphical visualization of actual and forecasted data is shown in figure 2.

Forecast of the number of jobs in accommodation services in the second quarter of 2020 does not show a massive impact on tourism employment. There is a noticeable decline which is expected due to the seasonal character of the employment data from previous period. More significant decrease is noticeable in prediction of third quarter of 2020.

Comparing number of jobs in the second and third quarters of 2020 to average employment in 2019, we can estimate a decrease by -12% on average, in absolute terms in the third quarter 2020 by -2,497 jobs.

This model indicates a negative impact of COVID-19 on tourism employment represented by the significant decrease of number of nights spent in accommodation establishments and turnover of accommodation services. Based on the 95% confidence interval we can find the

values of predicted number of jobs in accommodation establishment for the second quarter of 2020 in a range 12, 647 – 13, 801 and for third quarter of 2020 between the values 11,304 – 12,908 with mean absolute percentage error -0,06%.

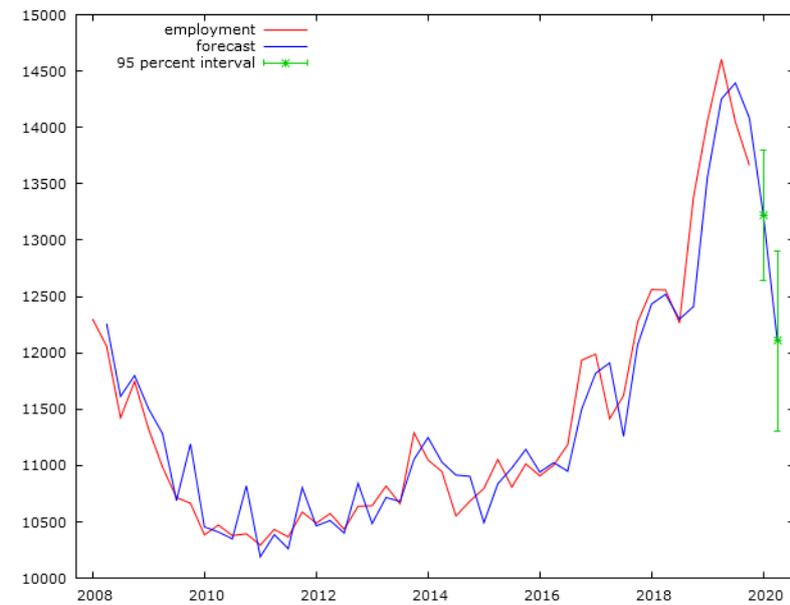


Fig. 2 – Forecast of number of jobs in accommodation services in the second and third quarter 2020. Source: own processing in GTREL

According to Slovak Tourism Association (OECD, 2020) in 2020 there is expected decrease of turnover in Slovakia by more than 50% comparing to the year 2019. In Slovakia in April and June 2020 there was recorded decrease of turnover in accommodation services averagely by 76%.

Statistical data shows us the value of the night spent represents decrease by 81% comparing to the same period in 2019, and cumulatively, in the first half of 2020 there is recorded and decrease by 50% comparing to the first half of the year 2019.

According to Association of Hotels and Restaurants of Slovakia - AHRS (2020) there is estimated a possibility of losing 38,000 jobs after the summer of 2020 in the tourism sector. According to TSA there is more than 150,000 jobs in tourism sector in Slovakia and accommodation services represents 11% of the total number of jobs in tourism sector (SOSR, 2020e). Loss of 38 000 represents decrease by 25% of all the jobs in tourism sector. So far, decline in accommodation services represents 15% comparing to the same period in the last year. The most important parameter for the future development of tourism employment, mainly in accommodation services, will be development of number of nights spend and turnover in accommodation services in summer season including vacation period in July, August and partially September. The major impact of COVID-19 on tourism employment will be able to measure in following months.

## 5 CONCLUSION

In this paper we estimated the impact of COVID-19 on tourism employment, namely in accommodation services as one of the main part of the tourism services. The prediction of the second and third quarter of 2020 was provided. We estimated the maximal possible impact of COVID-19 on employment in accommodation services. The impact may not be as significant as we estimated, if there are any supportive measures from government designed for the

enterprises that are directly affected by corona crisis. The most significant losses in tourism sector pertain to accommodation establishments, travel agencies and tour operators and catering services (OECD, 2020).

The aim of our paper was to quantify the impact of COVID-19 in accommodation services related to direct impact on the employment. The results showed us that COVID-19 has a negative impact on employment in accommodation establishments. The value of the job loss is estimated to be more than 2,497 jobs in the third quarter of 2020 which is a change by -17% comparing to the same period in the last year. If there is COVID-19 spreading at the same or bigger scale and the restrictions towards travelling and the movement within the country and to other countries are more and more strict, there can be fatal consequences towards the employment in accommodation sector in Slovakia. One of the main topics in tourism before the pandemic was to create a sustainable tourism development (UNWTO, 2017). Nowadays, the topic should be considered even more. According to (Zenker & Kock, 2020) sustainability in tourism sector is internally driven by stakeholder's consent and might be more open to change and innovations (Sigala, 2020). However, in Slovakia there need to be created a base ground in terms of government support, which may help to recover the businesses after the fatal shocks during the first months of the pandemic.

The real data may show us slightly different number due to the fact that we considered only two main variables, which may affect the development of number of jobs in accommodation establishment, we did not consider any social impact, an insolvency of the accommodation establishments or an employee behaviour towards the current situation. Our forecasted models express the maximal predicted loss based on development of number of nights spent and turnover in accommodation establishments for the second and the third quarter of 2020.

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# THE ROLE OF PERFORMANCE ON FIRM VALUE: THE MODERATION MODEL OF INNOVATION IN VIETNAM

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## **Abstract**

This paper aims to investigate the moderation of innovation on performance and value for 23 technology companies and financial institutions on the Vietnam Stock Exchange from 2011 to 2019. The fixed effects, the random effects, and the two-step Generalized Method of Moments (GMM) are used to process the collected panel data via four formulated quantitative models. Two hypotheses have been tested, and the results supported both hypotheses. The relationship between firm performance and firm value is a significant positive sign, and there is a significant statistically the moderation of innovation on the link of performance and value. The outcomes are assessed as suitable to the operating conditions of the financial and technology industry.

*Keywords: Innovation, performance, value, finance, technology, company*

## **1 INTRODUCTION**

Performance management is considered into two aspects which are the definition and the measurement of goals attainment, and meet all shareholders' aspirations in both financial and non-financial goals (Otley, 1999). Performance management is presented by firm performance. (Otley, 1999) stated that there was an existence of the relationship between performance and value. The study of (Ducharme, Malatesta & Sefcik, 2001) demonstrated the role of earnings management on the negative relationship between performance and valuation in the pre-initial public offerings stage; the existence of impact of learning capability on firm performance, it created value for shareholders (Prieto & Revilla, 2006); the finding of (Ogundipe, Idowu, & Ogundipe, 2012) gave that the negative impact of working capital management on the link of performance and market value of companies on Nigeria Stock Exchange. These studies above investigated the relationship between performance and the value, but the results of this relationship are not clear. According to our best knowledge, until the present, in Vietnam, there has not been any study to consider the moderation of innovation on the relationship between performance and value of financial institutions and technology companies. Innovation plays the most important role in firm performance (Hagedoorn & Schakenraad, 1994; Devlin, 1995), which helped organizations maintained competitive capability through product differentiation. Consider the impact of innovation on the value the result of the study review of (Mitchell, 2003) indicated that technology innovation was a key factor to enhance the firm value. Another study (Amit & Zott, 2012) gave that the firm created and added value through business model innovation. Overall, the company may innovate products, processes, marketing, and organization (Kafetzopoulos & Psomas, 2015) to achieve their goals for both managers and shareholders, who are always considering performance and the firm value.

The authors have found that performance influences the value in the same direction for innovation. However, this finding may be common in the characteristics of each economic environment. Vietnam is a developing country, the moderation of innovation on performance - value may be different, it may also lead to being different from the finance industry and the technology industry. Therefore, this study aims to investigate the moderation of innovation on the relationship between performance and value of financial and technological companies in Vietnam.

## 2 THEORETICAL BACKGROUND

### **The relationship between performance and value**

There are many ways to measure firm performance, in theoretical such as (Kaplan & Norton, 1992), they were the original of multidimensions approaches. In experimental, firm performance was measured by eight factors: efficiency, growth, profit, size, liquidity, success/failure, market share, and leverage (Murphy, Trailer & Hill, 1996); by three major systems of organizational control: budgeting, economic value-added, and the balanced scorecard (Otley, 1999); and by throughout three dimensions: productivity, operational performance, and financial performance (Kafetzopoulos & Psomas, 2015). All experimental methods have a common point is to reflect the consequences of the company's operation in the period. The company has a good performance, this means most performance measures achieve expected goals, it is a background to evaluate the firm value. The impact of performance on value has been investigated by some empirical studies, and it was described in different ways. (Tahat, Ahmed & Alhadab, 2017) indicated that intangible assets (innovations) such investments could increase firm earning and value. (Haji & Mohd Ghazali, 2018) examine intangible assets and firm performance of Malaysian companies. they suggest that intangible liabilities have significantly limited control. Tangible liabilities lead to negative while tangible assets have positive and significant influence on firm performance. (Sellhorn & Stier, 2019) pointed fair value measurement through different accounting rules and concluded that fair value measurement predicts future firm performance. (Özbay, 2018) examines corporate reputation and market value employing panel data. Intangible assets represent corporation reputation in his study. The results of study revealed a positive relationship between corporation reputation and firm value. Vig, Dumičić and Klopotan (2017) investigate the relationship between firm performance and firm value, reputations. ROE also employed as firm performance measure and concluded that most dimensions of firm reputations leads to enhance firm performance. Bayraktaroglu, Calisir and Baskak (2019) studied innovation capital in Turkish manufacturing firms by employing multiple regression analysis. The result of the study suggests that innovational capital efficiency moderating effect of firm profitability. The study of (Kaplan, 1983) about measuring manufacturing performance of the US company emphasized the positive link between productivity and the firm value, with the value may be increased by improving productivity. Another experimental study on the Indonesia Stock Exchange of Sudiyatno, Puspitasari and Kartika (2012) and Sudiyatno, Puspitasari and Sudarsi (2017) has a finding that performance has positive and significant on the value. The same result of a positive relationship between performance and the value of listed companies on the Dow Jones Stock Exchange in the USA (Yu & Zhao, 2015). Overall, the results of previous studies have validated that the existence of the relationship between performance and value, and this is a positive relationship. Therefore, the hypothesis has been set up as below:

*H1: There is a positive relationship between performance and value.*

### **Moderating impact of innovation on the relationship between performance and value**

There is a large gap between market value and a book value of the firm (Chen, Cheng & Hwang, 2005) showed the ratio of market value on the book value of listed companies on the S&P 500 was from 1 to over 5. The limitation of financial statements does not reflect the value of intangible assets, while intangible assets include human capital, technology, innovation has been playing an increasing firm value (Kim & Taylor, 2014) and (Kohlbeck, 2004). An empirical investigation of (Chen, Cheng & Hwang, 2005) about the relationship between intellectual capital and market value and performance found that intellectual capital had a positive impact on market value and performance of the company. Besides intellectual capital,

knowledge sharing was also a positive factor in firm performance in both financial and operational (Wang, Wang & Liang, 2014). The company's acquiring success and competitive advantage is enhanced by the role of knowledge-innovation. The result of Dost et al. (2016) contributed to the significant positive impact of intellectual capital and knowledge on innovation, and this relationship made to increase the level of the company. Soto-Acosta, Popa and Palacios-Marqués (2015) examines organizational innovation and firm performance in Spanish manufacturing SME's. they grounded knowledge-based review and technology organization environment and suggests that organizational innovation positively associated with firm performance. Clauss (2017) measured business innovation model by three dimensions and contributed significant role of innovation in business models. The study of (Silveira et al., 2020) revealed that R&D activities increased overall expenditure of firm. So, firms should tradeoff between value creation and value appropriation by allocation of resources synergy. Fontana, Coluccia and Solimene (2019) observe explicative variables intangible assets, Tobin's q and disclosed that positive relationship exists between variables. Herciu and Șerban (2018) examine firm performance which was measured by Tobin's q. The result of the study suggest that firm performance is influenced by assets growth, R&D and it could be much more factors considered while analyzing it in detail. R&D and different other variables analyzed in line with innovation activities to determine its effect on firm performance and value. As the study of (Karbowski & Prokop, 2019) analyzed R&D and firm performance and pointed that innovation enhanced the vertical integration of the industry.

R&D activities play the most important in the innovation of the company, it is a core activity to lead the company moving forward and enhance the competitiveness capability. R&D expense is distributed on innovation quality (Lahiri, 2010), such as a link to upgrade/create a product, technology diversity, and link to the effectiveness of the company. The study results of (Abrahams & Sidhu, 1998) on the Australia Stock Exchange showed that the capitalized R&D improved accounting earnings as a firm performance, which had a positive link to the market return. Besides, R&D productivity was the key to balancing increase sales with decrease cost to maximized shareholder returns (Boer, 1994). Innovation played a role in the company operation, it contributed to the firm performance and it is a part of firm value (Fatemi, Glaum & Kaiser, 2018). Overall, the impact of firm performance on firm value is expected to be influenced by innovation. Thus, the second hypothesis of this study will be:

*H2: Innovation has a moderating impact on the relationship between performance and value.*

From the above, the conceptual model is proposed as Fig. 1:

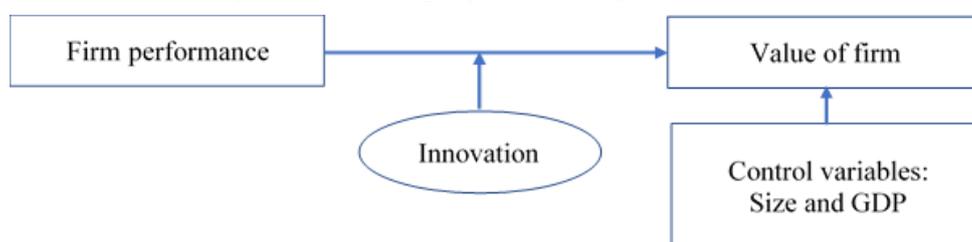


Fig. 1 – Conceptual Model. Source: own research

### 3 METHODOLOGY

#### Sample and data collection

This study uses the panel data of 23 financial institutions and technology companies, which are listed on the Vietnamese Stock Exchange for 9 years from 2011 to 2019. The data set including mainly audited financial statements and annual reports are solicited from the Vietstock, a trusted

statistical organization in Vietnam. The market value of equity, short-term and long-term debt are collected from the historical data of each company on the database of the Vietstock, the market value was recorded on the last working day of the financial year. The gross domestic product growth rate is collected on the website of the World Bank.

The firm value variable is measured by Tobin's Q, which is a common value in the study of Sudyatno, Puspitasari and Kartika (2012), Yu and Zhao (2015) and Fatemi, Glaum and Kaiser (2018). Tobin's Q is the sum of the market value of equity, short-term debt, and long-term debt divided by total assets.

Tab. 1 – Describe the Detail of Variables. Source: own research

Variable		Measure
Firm value	VAL	Tobin's Q: The sum of the market value of equity, short-term debt and long-term debt divided by total assets
Firm performance	ROE	Returns on equity: Net income to shareholder equity
Innovation	INN	Intangible assets on total assets
Size	SIZ	Firm size is measured as a natural logarithm of total assets
GDP	GDP	The gross domestic product growth rate

Measures of firm performance are very various, but there is not any comprehensive measurement of performance which can fit for all companies. The authors argue that a reasonable approach that is appropriate in the research conditions will be better than the best method. Therefore, in this study, the authors use a profitability indicator which is the return on equity to represent performance variables. The return on equity had been used by (Murphy, Trailer & Hill, 1996) and (Hall & Bagchi-Sen, 2002).

R&D activities have a strong link to innovation. The study of (Hall & Bagchi-Sen, 2002) indicated that R&D intensity correlated with innovation, it may be a representation of innovation in a research study. Innovation is measured by R&D activities is the indirect method, which has some disadvantages: R&D is an input to the innovation process, all innovations do not necessarily stem from R&D, and it tends to favour large companies over SMEs (Becheikh, Landry & Amara, 2006). However, R&D measure is also used by many studies (Flor & Oltra, 2004), (Kleinknecht, Van Montfort & Brouwer, 2002). R&D variable was defined as R&D intangible investments it was measured by various approaches such as throughout accounting-related, operating performance, and market performance (Anagnostopoulou, 2008). In this paper, the R&D variable is an intangible fixed asset on the balance sheet, it meets International Accounting Standard requirements (Lev, 2000). Control variables were found to be relevant to the studies reviewed (Mak & Kusnadi, 2005) and (Fang, Palmatier & Steenkamp, 2008): the firm size and the gross domestic product growth rate.

## Research models

To empirically investigate the moderation of innovation on performance and value of financial institutions and technology companies on the Vietnam Stock Exchange, the authors use a simple accelerators value model to which we add our measure of innovation. We use the following specification.

Model 1:

$$VAL_{it} = \alpha_i + \beta_1 SIZ_{it} + \beta_2 GDP_{it} + \beta_3 ROE_{it} + \varepsilon_{it} \quad (1)$$

Model 2:

$$VAL_{it} = \alpha_i + \beta_1 SIZ_{it} + \beta_2 GDP_{it} + \beta_3 ROE_{it} + \beta_4 INN_{it} + \varepsilon_{it} \quad (2)$$

Where  $i = 1, \dots, n$  (23 firms);  $t = 1, \dots, 9$  (9 years, from 2011 to 2019), and  $\varepsilon_{it} = \mu_i + \lambda_{it}$  is error term with  $\mu_i$  is the individual specific effect to cover the specific heterogeneity, and  $\lambda_{it}$  is individual time-varying across individuals and over time.

We further analyze the nature of the relation between performance, value, and innovation by investigating whether the degree of innovation affects the performance-value relationship; and (Griliches, 1981) gave that firm value was affected by the lag of innovation. Therefore, to investigate, we test the following model specification:

Model 3:

$$VAL_{it} = \alpha_i + \beta_1 SIZ_{it} + \beta_2 GDP_{it} + \beta_3 ROE_{it} + \beta_4 INN_{it} + \beta_5 (ROE * INN)_{it} + \varepsilon_{it} \quad (3)$$

Model 4:

$$VAL_{it} = \alpha_i + \beta_1 SIZ_{it} + \beta_2 GDP_{it} + \beta_3 ROE_{it} + \beta_4 ROE_{i(t-1)} + \beta_5 INN_{it} + \beta_6 INN_{i(t-1)} + \beta_7 (ROE * INN)_{it} + \beta_8 (ROE * INN)_{i(t-1)} + \varepsilon_{it} \quad (4)$$

Where,  $ROE_{i(t-1)}$ ,  $INN_{i(t-1)}$ , and  $ROE * INN_{i(t-1)}$  are performance, innovation, and the interaction between performance and innovation of the company  $i$  at the time  $t-1$ , respectively.

### Model processing

Firstly, descriptive statistics are shown (Tab. 2). Secondly, the correlation between the study variables and the variance influence factor are used to determine the suitability of variables in the quantitative models. Thirdly, to have a consistence and efficiency results for testing two hypotheses, three methods are used to process the panel data, which are the fixed effects (FE), random effects (RE), and the two-step Generalized Method of Moments (GMM). In the regression model of using panel data, the estimation result of GMM is considered as the best for explaining the relationship between variables in the regression models, because the result of GMM does not have multicollinearity and autocorrelation, which may exist on the results of FE and RE (Arellano & Bond, 1991). The GMM is used to estimate for panel data regression when it meets requirements: the number of groups is more than the number of instrument variables, and there are endogenous variables in the original model (Wooldridge, 2001). Based on the study of (Hansen, 1982) about the determinant instrument variables for the GMM method, the endogenous variables in model 1-4 are firm size, performance, and innovation. The impact of the firm value variable on three endogenous variables was explained by (Schipper & Thompson, 1983), (Hall, 1999), and (El-Sayed Ebaid, 2009). The study in the merger and acquisition activities of (Schipper & Thompson, 1983) confirmed that the firm value made a change in the profitability of the firm. While most studies focused on the impact of innovation on the value, the study of (Hall, 1999) had a finding that the firm value played the role of supporting the firm innovation. The results of the model the impact of value on performance, (El-Sayed Ebaid, 2009) revealed that the size performance was affected by the value performance. The exogenous variable in the GMM is validated to be the GDP variable because it reflects the change of macro condition, which influences the operational company. Under the support of Stata Statistical Software, we have found out the best results of GMM which meets these requirements of the GMM process.

## 4 RESULTS

The Tab. 2 indicates descriptive statistics of the main variables used in the model specifications. Most variables have 207 observations for 23 companies in 9 years, except the GDP variable has 9 observations that are represented for a macroeconomic condition yearly and are repeated for each company.

The VIF in Tab. 3 indicates the variance inflation factor value, that is used to evaluate the level of multi-collinear between variables in a regression model. the maximize of VIF is 1.55 (<4.00), which is under the threshold value of VIF of the model having less than ten independent variables (Salmerón Gómez et al., 2020) and (O'Brien, 2007). Tab. 3 also shows that the maximum of the correlation coefficient between pairs of explanatory variables is 0.488 (<0.50), hence, all variables are eligible to be included in the regression analysis model, and there is no multi-collinear between the variables (Gujarati & Porter, 2009). Besides that, the information in Tab. 3 shows that value (VAL) and performance (ROE) variables are positively correlated at the correlation coefficient is 0.488. Yet, this at least suggests that there may be a positive association between performance and the value, a result that is found in most empirical studies on this issue. There is a negative relationship between innovation and value, and between innovation and performance, but the correlation coefficients are extremely low (-0.067) and (-0.044) respectively.

Tab. 2 – Descriptive Statistics. Source: own research

Variables	Obs.	Mean	St. dev.	Min.	Max.
VAL	207	114.12	82.46	22.54	676.32
SIZ	207	9.02	3.14	2.71	14.03
GDP	9	9.57	3.89	3.78	16.91
ROE	207	0.14	0.11	-0.30	0.47
INN	207	2.56	4.63	0.01	24.92

The moderation of innovation on the link between performance and value is presented in Tab. 4 by using three methods (FE, RE, and GMM) for four models above. Before discussing the estimation results two hypothesizes above, the author will present some common results in Tab. 4. *Firstly*, the F-Statistic value of the FE and the Wald-Chi2 value of the RE and the GMM (the Stat. Value rows on Tab. 4) shows that all results of regressions are significant at 1%. *Secondly*, the value of R<sup>2</sup> from 0.1349 to 0.2982 of the FE and RE results mean from 13.49% to 29.82% the change of the company's value is explained by the independent variables in each model. *Thirdly*, in the results of the GMM processing, the AR (2) value shows that the correlation in the residuals of the models is not statistically significant, which means four models do not correlate the remainder (Arellano & Bond, 1991), the instrument variables in four model of the GMM are reasonable and not correlated with the residuals, it is proved by four Hansen values, which are not statistically significant (Hansen, 1982). Finally, discussion about two control variables in the models. The size is the factor to make increasing the firm value, it is generally similar to the result of (Mak & Kusnadi, 2005), and it is a direct effect (Setiadharmas & Machali, 2017) when total assets are increased, it sends a good signal about the increasing of the firm value to investors. The coefficient of GDP is a negative sign to the firm value, it is the difference from the result of (Fang, Palmatier & Steenkamp, 2008), this means financial institutions and technology companies will have a good chance for development when the gross domestic product growth rate decreases.

Tab. 3 – Correlation Matrix and Variance Influence Factor. Source: own research

	VIF	VAL	SIZ	GDP	ROE	INN
VAL	1.45	1.000				
SIZ	1.55	0.380	1.000			
GDP	1.04	-0.140	-0.043	1.000		
ROE	1.43	0.488	0.365	0.055	1.000	
INN	1.27	-0.067	-0.435	-0.031	-0.044	1.000

Most ROE coefficients validate the positive significant impact of performance on value at 1%, it is like as the expectation of the first hypothesis that is a positive impact of performance on value. However, the outcomes of GMM model 3-4 do not confirm our expectation about the relationship between performance and value, it is a difference from the results of Sudiyatno,

Puspitasari and Kartika (2012), Yu and Zhao (2015), and Sudiyatno, Puspitasari and Sudarsi (2017). This means when the weaknesses of the FE and RE methods have been solved by the GMM method, the coefficient of ROE is negative.

Tab. 4 – The Moderating Role of Innovation. Source: own research

	FE	RE	GMM	FE	RE	GMM
	<b>Model 1</b>			<b>Model 2</b>		
Constant	156.34 [1.51]	56.00* [1.80]	141.41*** [3.22]	105.46 [0.98]	32.90 [0.93]	22.91 [0.66]
SIZ	-4.72 [-0.42]	5.80* [1.89]	-5.11 [-1.14]	-0.46 [-0.04]	7.57** [2.25]	0.35 [0.08]
GDP	-3.52*** [-3.25]	-3.18*** [-3.13]	-2.15*** [-3.37]	-3.21*** [-2.94]	-3.01*** [-2.96]	-3.71** [-1.98]
ROE	249.42*** [4.51]	265.32*** [5.18]	232.60** [1.98]	243.53*** [4.42]	257.81*** [5.03]	875.32*** [3.54]
INN				4.02* [1.73]	2.56 [1.48]	2.14* [2.07]
N	207	207	184	207	207	184
Sta. Value	9.74***	45.65***	12.54***	8.13***	47.32***	83.69***
	R <sup>2</sup> : 0.1390	R <sup>2</sup> : 0.1348	AR (2): -0.64 Hansen: 13.08	R <sup>2</sup> : 0.1531	R <sup>2</sup> : 0.1474	AR (2): -0.09 Hansen: 17.45
	<b>Model 3</b>			<b>Model 4</b>		
Constant	142.77 [1.35]	49.02 [1.36]	66.44 [1.12]	173.50 [1.49]	50.23 [1.23]	41.71 [0.39]
SIZ	-2.68 [-0.24]	7.33** [2.16]	16.42* [1.75]	-7.38 [-0.61]	5.24 [1.38]	27.45* [2.37]
GDP	-3.62*** [-3.36]	-3.28*** [-3.28]	-0.88 [-0.72]	-3.61*** [-2.66]	-3.11** [-2.39]	1.98 [1.17]
ROE	140.78** [2.22]	155.22* [2.56]	-998.25*** [-3.50]	237.88** [2.56]	235.19*** [2.66]	-1455.43*** [-3.24]
ROE (t-1)				29.97 [0.43]	30.17 [0.44]	199.06 [0.59]
INN	-2.72 [-0.86]	-2.81 [-1.12]	-15.56*** [-4.11]	-7.70 [-1.16]	-4.27 [-1.01]	-77.82*** [-4.62]
INN (t-1)				-4.27 [-1.31]	-3.11 [-0.98]	46.21** [2.46]
ROE*INN	54.56*** [3.09]	49.87*** [3.00]	233.75*** [7.55]	48.40* [1.75]	38.16 [1.52]	369.86*** [5.58]
ROE*INN (t-1)				64.09*** [3.17]	52.23*** [2.68]	41.71 [0.39]
N	207	207	184	184	184	161
Sta. Value	8.72***	57.30***	96.33***	8.13***	76.92***	1454.63***
	R <sup>2</sup> : 0.1959	R <sup>2</sup> : 0.1907	AR (2): -1.12 Hansen: 9.02	R <sup>2</sup> : 0.2982	R <sup>2</sup> : 0.2916	AR (2): -0.58 Hansen: 7.44

Note:

Sta. Value: FE is F-statistic; RE and GMM are Wald-Chi2

\*\*\*, \*\*, and \* donate statistical significance at 1%, 5%, and 10% respectively

The results of tab. 4 are also generally consistent with the second hypothesis, innovation has a moderating impact on the relationship between performance and value. Model 2 shows that when the ROE\*INN is not considered, the outcomes indicate the significant positive impact of ROE and INN on the firm value at 1% and 10% respectively. However, when the interaction of performance and innovation (ROE\*INN) and the lag one year of ROE, INN, and ROE\*INN are put on model, the significant coefficients of ROE and INN have changed the sign from positive to negative, but the significant coefficients of ROE\*INN and ROE\*INN(t-1) are positive. Our findings suggest that the firm value does not only stand to gain significantly from performance and innovation individually, but it is also impacted by the interaction of both factors. Based on the results of the GMM model 4, since 2011 all the companies in the sample have been doing two tasks simultaneously, and the interaction of them has a significant positive impact on the firm value. The first is the effective transformation of intangible assets into

tangible assets, this is a reason why the coefficient of INN is a significant positive and coefficient of INN(t-1) is a significant negative. The second is that the company focuses on more innovation, it is represented by allocating income into the R&D activities, this is a good explanation for the coefficient of ROE and INN are negative but the coefficient of ROE\*INN and ROE\*INN(t-1) are positive. This is suitable to the current situation of the finance and the technology industry, innovation is the core factor for development (Gomber, Koch & Siering, 2017) and (Zhang & Gallagher, 2016).

## **5 DISCUSSION**

This paper investigated whether innovation moderates the relationship between performance and value is moderated by innovation of 23 finance institutions and technology companies on the Vietnam Stock Exchange from 2011 to 2019. Based on the literature review, two hypotheses were set up to examine the moderation of innovation on the relationship between performance and value of financial institutions and technology companies in Vietnam. Three methods of processing panel data (FE, RE, and GMM methods) were used to estimate four quantitative models that were formulated to examine two hypotheses. The results confirm that there is a significant positive relationship between performance and value, and the moderation impact of innovation on the relationship between performance and value. Besides that, based on the outcomes, other findings are found in the finance and technology industry. Firstly, when the gross domestic product growth rate is decreased, it is a chance for the development of the finance and technology company. Especially in the context of COVID-19 that is ongoing and is a signal of a new global economic crisis (Nicola et al., 2020) and (Zhang, Hu & Ji, 2020). Based on that, the authors believe that the managers should prepare the adaption strategy when the crisis occurs. It could remark a new milestone in the business life cycles. Secondly, innovation plays the most important role in the company operation, especially when it is considered simultaneously with performance. The interaction of performance and innovation has a positive impact on the firm value, although both they have a negative sign individually on value, and it is suitable for the current situation of the finance and technology industry. Hence, the authors propose that before making the decisions that relate to innovation, the managers should consider in the multi-dimensional relationship innovation – performance - value, and the long-term strategy because of the lag of innovation.

### **Limitation and Future Research**

The research is limited to nine years of data only, i.e. from 2011–2019, accordingly, a complete investigation comprising a normal time, it may provide mixed outcomes could not produce significant inferences. This research is based on secondary data collected from the Vietstock, according to which the nature of the investigation depends only on the accuracy of the data and the authenticity of the secondary data. The influence of the data source can affect the results of the estimation and explained the analysis results. Instead of studying the finance and technology companies, future research could focus on the service and manufacturing sectors. COVID-19 has been influencing all aspects of socio-economic (Nicola et al., 2020), and the role of innovation has been level up, it emerges as key for every issue (Baker et al., 2020). Therefore, the result of the moderation of innovation on performance and value in the new context of COVID-19 may be the interesting findings, it could be considered in the future studies. Researchers can also use business strategy as a moderator to get more interesting results regarding cost leadership effect on firm performance and value.

## 6 CONCLUSION

Researchers have conducted several experiments to determine what defines a firm's performance and value. We examined whether innovation moderates the relationship between performance and value of 23 finance institutions and technology companies on the Vietnam Stock Exchange from 2011 to 2019. We have adopted three methods to process the panel data, which are the fixed effects (FE), random effects (RE), and the two-step Generalized Method of Moments (GMM). Fintech is the hybrid company of the financial institution and technological company, and since the global financial crisis in 2008-2009, it has been dramatically growing (Arner, Barberis & Buckley, 2015) and (Goldstein, Jiang & Karolyi, 2019). Our result showed that there is a significant positive relationship between performance and value, and the moderation impact of innovation on the relationship between performance and value. Innovation activities enhance the value and performance of a firm. The sample data from Vietnam, is subject to correlation test which indicate that there are no high correlations between the independent variables and therefore no multicollinearity problem exists. Which afterward we check with the command of VIF and found its value is 1.55 which is less than threshold value mean no multicollinearity in the model. To this end our paper indicates that innovation significantly moderate the relationship between firm performance and value.

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# ENTERPRISE INFORMATION SYSTEM, INFORMATION VALUE AND ECONOMIC SECURITY OF ENTERPRISE

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## **Abstract**

Maintaining economic security of enterprise should be effectuated by preventing any significant loss of assets. Information is widely perceived as one of the most important assets for enterprise. Losing information assets is therefore crucial threat to any modern enterprise. There is a wide research on data and information cybersecurity, but very rarely scientists discuss the business point of view on information value, information quality and on the integration of enterprise information system with business processes. Based on the standardized risk management process the economic security of enterprise in the area of enterprise information system can be maintained by identifying, analysing, evaluating and treating information risks. The information risks impacts are related to poor information quality, which reduces value of information as an enterprise asset. Based on the enterprise information system integration with business processes the devaluation of information asset disseminates across the whole enterprise and reduces the economic security of enterprise. The aim of this article is to identify the primary sources of risks which should be considered as the highest priority risks in order to early detect negative impacts of poor-quality information on the economic security of enterprise. This article contributes to the literature on information risks by analysing interdependence of information risks using KARS method. The capability of information risks to activate other information risks, and hence, to promote dissemination of negative impacts across the whole enterprise is evaluated. Four groups of information risks are identified based on their capability to activate or to be activated by other information risks. This article identifies information risk sources – lack of integration between IT and business processes, and lack of awareness of the value of information – as the primary dangerous sources of information risks.

*Keywords: security, information, quality, economy, enterprise, risk*

## **1 INTRODUCTION**

Economic security of enterprise is a state of a system in which it is capable of effectuating its main functions without any substantial loss of assets. The loss of assets origins in omitting impacts of risks, which can develop into acute crisis phase in a lifecycle of enterprise. Buganova et al. (2012) suggest to adopt an early warning system for enterprise to prevent the development of crisis. The system should cover all functional areas of enterprise to detect impacts of relevant risks on the organization's performance. Neumannova et al. (2012), Chevalier (1994), Simak (2006), Fotr (2005) and Varcholova (2008) studied crisis and associated risks and suggested preventing measures. A continuous risk management process is a systemized approach to identify, analyse, evaluate and treat risks in order to prevent crisis. Kasik et al. (1998), Borek et al. (2013), and Hittmar et al. (2013) studied enterprise information system as a special area to be prevented from the impacts of risks. Ballay et al. (2017) focus on security benefits stemming from intelligent transport systems. Information is considered as one of the most important assets to be secured from serious damage. Madden (2000) describes information as a resource or commodity, Dubova (2018) identifies non-price factors in valuing information and Moody (1999) offers valuation of information by seven laws of information.

The aim of this article is to identify the primary dangerous sources of information risks which should be analysed, evaluated and treated according to a standardized risk management process to maintain economic security of enterprise in the field of information assets. Based on the information value as an asset value to enterprise, and based on the information quality dimensions as measurable characteristics of information, the primary dangerous information risks are identified using analytical method KARS. Primary dangerous information risks should be measured in terms of their impact on enterprise in order to create any effective early warning system. This article identifies two sources of primary dangerous information risks, which can activate the highest portion of other information risks, lack of integration between IT and business processes, and lack of awareness of the value of information for enterprise.

## **2 THEORETICAL BACKGROUND**

### **2.1 Economic security of enterprise**

Based on the concept of economic security of enterprise (ESE), we identify enterprise information system as one of the functional areas of an enterprise structure, which should be considered in maintaining ESE. ESE is maintained during the life cycle of an enterprise by keeping track of indicators which signal any imbalance in the structure of business processes of the enterprise. The imbalances may cause significant loss in the enterprise's assets value and negatively affect economic security of the enterprise.

In the literature, there are various approaches to the concept of ESE. Grigoruk (2009) considers ESE as an institution of governance that establishes the rules of economic activities of the enterprise, and reforms them in case of loss of adequacy under crisis and risk. Internal threats and risks besides external ones are also considered by Pletnikova (2001). Shemayeva (2010) points out the need for accepting the external threats as opportunities which should be utilized in order to ensure security. Kapitula (2009) or Strelcová (2015) discuss relationship between threats and firm's assets reduction. Kuzenko (2004), Reznikov (2011) and Yaremenko (2009) point out that limitation of resources management only to prevention of losses closes many opportunities for enterprises. In other words, Kirienko (2000) describes ESE as an optimal use of economic potential of enterprise. Kamyshnikova (2010) and Oleynikov (1997) describe ESE as a combination of several components of the enterprise resources, financial, technical and technological, human resource, information and ecological. There is widely elaborated the term system in the definitions of ESE. The term helps to describe the complexity of the economic security as well as the interdependence of the external and internal environment of enterprise. Through system approach Rudensky (2002) points out that ESE is not only eliminating the consequences of threats but also an opportunity to avoid threats by preventing measures and procedures. Podluzhna (2003) sees ESE as a feature of self-developing and self-organizing system, enterprise. Nagorna (2008) discusses ESE through the prism of the enterprise's external and internal network of direct and indirect relationships. ESE is then a state of economic system of the enterprise's internal environment that during the whole life cycle of the enterprise is able to successfully neutralize its own internal as well as external threats without suffering from significant losses of resources. (Shutyak et al., 2015)

Skachko et al. (2020) develop a methodology for assessing ESE. Zubko (2019) proposes a system of components of ESE. Gagarina and Sorokina (2017) suggest to aim activities at ESE based on international standards. Dadalko (2017) stresses the importance of threats analysis in the construction of a system of ESE. Similarly, Chunaev (2018) discusses the importance of diagnosis of threats for ESE. Maintaining ESE by preventing crisis phase in the life cycle of an enterprise is the core activity of enterprise crisis management. It is based on the identification of imbalances which show up as symptoms. These symptoms should be identified within the

early warning system through properly defined indicators. Buganova et al. (2012) consider for an early warning system indicator from functional areas of an enterprise: finance, marketing, production, purchasing, logistics, development and human resource. They identify a wider set of indicators for each functional area. Similar functional areas are identified in the enterprise diagnostics approach by Neumannova et al. (2012). In the field of risk management there are also similar functional areas to be considered. Chevalier (1994), Simak (2006), Fotr (2005) or Varcholova (2008) identify among other functional areas risks which are related to information. Information processing area is identified by Kasik et al. (1998) as one out of three cross-sectional areas: innovation processes, strategic management, and enterprise information system. Enterprise information system accompanies mostly every business process within an enterprise. Its main function is to support business processes with high quality information. The high quality of information ensures that the most of information value is utilized for the benefit of an enterprise and for its economic security.

## **2.2 Information value, information quality and enterprise information system**

Preservation and utilization of information value is crucial for maintaining ESE. Information as an economic commodity in the role of an enterprise asset deserves serious protection through a well-developed process of information quality management. Assessing the value of information as an asset is different from pricing any common economic good. Thomsen (2003) considers information as a critical asset to an organization. Lopes da Cruz (2016) stresses the need to objectively assess the information value as we live in the information age. Sheridan (1995) considers the cost of information only a part of the value of information. Schaal (2000) estimates the value of information as the likelihood of reaching a situation in which the information is relevant. Jiang et al. (2016) state that information plays a key role in the competition of enterprises, and study an optimal investment portion on the market research and the competitor research.

Madden (2000) lists 4 ways of looking at information, 4 concepts: information as a representation of knowledge, information as data in the environment, information as part of the communication process, information as a resource or commodity. Concerning the last concept, it states that information is transmitted in a message, and there can be added value from dissemination or exchange of the information. This concept helps us to understand the importance of utilizing information value in order to achieve higher levels of economic security of enterprise. ESE depends highly on the awareness of the information value for enterprise and on the maximum possible utilization of the information value. Moody (1999) states that information lacks its quantitative measurement. It is not straightforward to express the value of information without any quantitative measure.

However, understanding the nature of information as a valuable asset is crucial to understand the importance of information quality management for ESE. The value which is utilized from information depends on the quality of information being processed within enterprise information system. If organizations managed other assets as badly as information assets, they would probably go out of business very soon. Enterprise information systems spread information assets through the whole enterprise and support most of the business processes. Information assets deserve the most possible precision in its quality considerations, because poor quality of information could impend overall ESE.

The current dynamic and global competitive market environment forces enterprises to use information for their business operations more effectively. It is a vital need for ESE to perform well-organized information quality management. Information as a key asset of an enterprise brings many risks when handled improperly. The threat of poor quality of information is a continuous problem for any enterprise. It could be caused intentionally by attacking the

confidentiality, integrity and availability of data and information, or it can be caused, and it is caused on daily basis, by poor information quality management.

Providing proper information quality management is based on consideration of various dimensions of information quality. The quality of information must be assured in each part of enterprise information system which is connected with related business process. Each business process relies on information quality according to a different group of information quality dimensions. As depicted in Figure 1, information quality has a multi-dimensional character. However, there is not a commonly accepted set of information quality dimensions that would fit to all businesses. Therefore, the information quality to be considered varies among organizations as well as it depends on the individual information needs for various business processes.

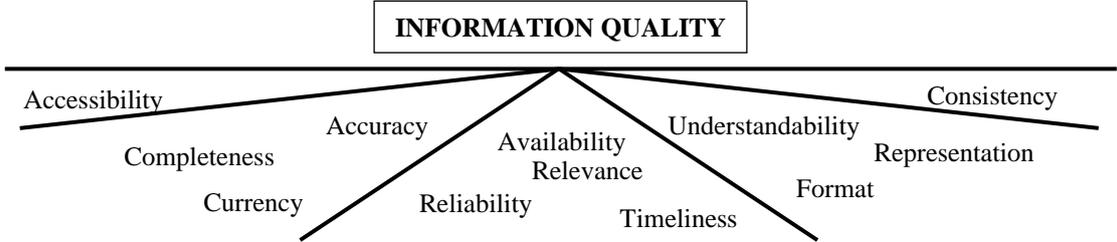


Fig. 1 – Data and information quality dimensions. Source: Borek et al. (2013)

The multi-dimensional character of information quality therefore calls for individual considerations of information quality by each enterprise for each business process to maintain its economic security. Such variability of businesses and business processes is reflected in the variability of design and architecture of enterprise information system.

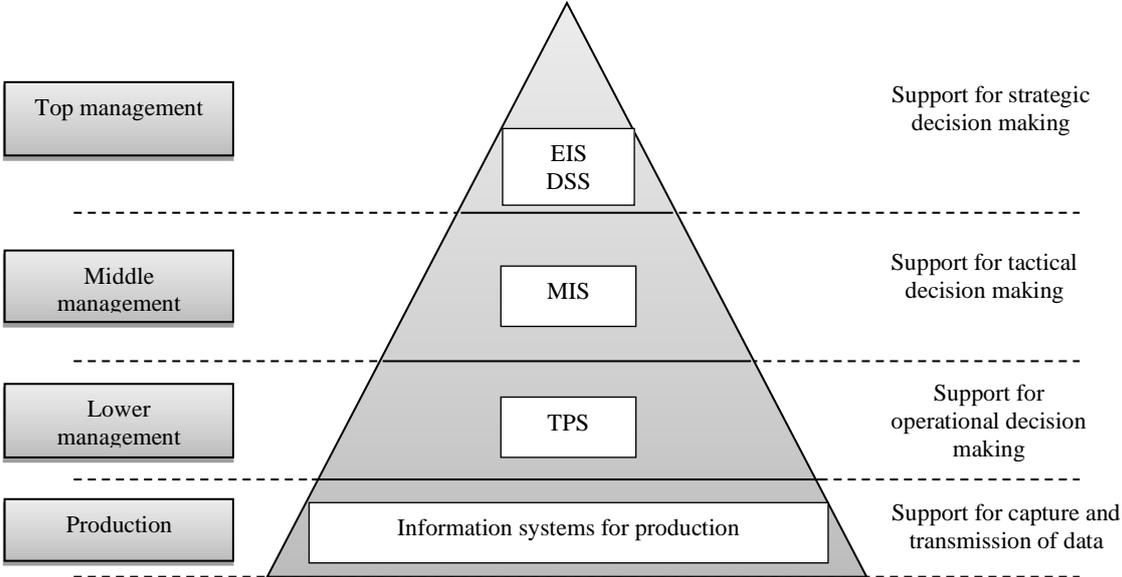


Fig. 2 – Levels of information system utilization. Source: according to Hittmar et al. (2013)

Enterprise information system is the space in which information quality management and utilization of information value takes place. On one hand, enterprise information system captures, stores, transmits and processes data and information. On the other hand, it influences individual business processes and functional areas of enterprise, and therefore it has the ability to change the whole character of enterprise. These preconditions determine enterprise information system as one of the key cross-sectional areas of interest, when evaluating ESE. There are various requirements on information quality for various business processes. The

requirements vary according to the functional area of business process, according to the level of management and also according to the links which enterprise information system has to external environment. Figure 2 and Figure 3 describe a general concept of enterprise information system and its links to external environment.

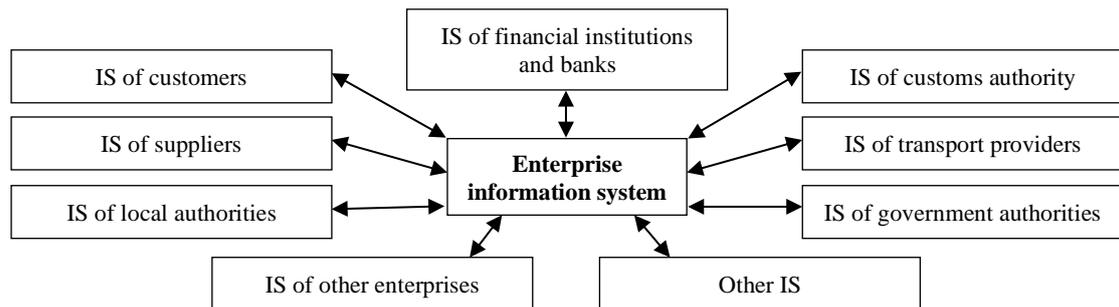


Fig. 3 – Enterprise information system and its links to external environment. Source: Hittmar et al. (2013)

The model of enterprise information system comprises of four levels at which information system support is utilized. The information system delivers utility for the enterprise by processing structured data at the lowest level, and semi-structured, and even unstructured information at the top level.

Current economic development calls for wider and deeper integration of enterprise information system with the external environment of enterprise. Business cooperation and more effective enterprise management call for information sharing among economic agents, which brings threats and risks. Preserving data and information quality when shared within the market should be also seriously considered in order to maintain ESE.

Information quality management enables an enterprise to utilize information value for the benefit of business processes, and for economic security. In general, organizations face internal and external influences which create uncertainty in achieving their objectives. These influences are expressed as risks with probability of occurrence and extent of impact on the organization. Enterprises should continuously manage external risks, macroeconomic and microeconomic, and internal risks which come from internal factors. Entrepreneurial risks can be distinguished also according to the focus of business area and its subject matter. Buganova et al. (2012), Neumannova et al. (2012), Chevalier (1994), Simak (2006), Fotr (2005) or Varcholova (2008) identify information technology related threats to businesses.

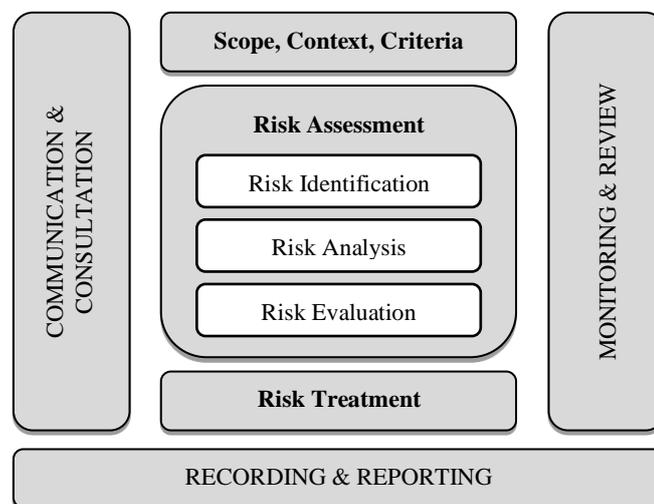


Fig. 4 – Risk management process. Source: ISO 31000:2018 Risk management – Guidelines

Standardized vocabulary, principles, framework and process of risk management are published in ISO Guide 73:2009 Risk management – Vocabulary, and ISO 31000:2018 Risk management – Guidelines. The purpose of risk management is to protect and create value following the basic principles of risk management. The process of risk management, as depicted in Figure 4, helps distinguish phases, stages and steps to be continuously effectuated in order to preserve and create value within organization.

International standards on risk management are not mandatory, and every organization can adopt individual version of the risk management process based on its business area or size. However, there are several risk management standards used widely among enterprises. Risk management process helps to protect and to create value within enterprise. Managing risks from processing information within enterprise information system helps to ensure necessary level of information quality, preserving and utilization of information value, and maintaining ESE.

### **3 METHODOLOGY**

This article explains the role of information value for ESE through an analogy of information with any common economic good which is used as an enterprise asset. Any loss in asset value undermines ESE, and hence loss of value of information assets undermines ESE as well. To protect the value of information assets information risks management should be integrated into enterprise risk management process. Such integration is Total Information Risk Management (TIRM) by Borek et al. (2013).

KARS analytical method serves for analysing interdependence among risks from a predefined set of risks. KARS can be effectively used in the risk analysis step of risk assessment stage of risk management process. Hoterova (2019) uses KARS analysis of risks to select those risks which should be treated by adopting security measures in order to develop safety plan of a key railway infrastructure element. Similarly, the aim of this article is to analyse 8 sources of information risks via KARS analysis to assess which information risks are of the highest priority for an enterprise.

The main goal of this article is to analyse information risks via KARS method, and to assess priority of analysed information risks. KARS method enables us to determine which risks are capable of activating the highest portion of other risks, and also which risks are capable of being activated by the highest portion of other risks. Priority risks are capable of activating the highest portion of other information risks. Identifying priority information risks therefore enables managers to detect poor quality of information at the very first possible moment, before negative consequences of poor data quality spread across the whole enterprise, and before negative effects of poor data quality translate into significant financial losses.

This article's main focus is on the risk analysis step within the risk assessment stage of TIRM process. It adds up a method to analyse information risks and set the priority of information risks, to the TIRM process. Taking a set of information risk sources from Borek et al. (2013), this article sets priorities to each of the information risk source based on implementing KARS analysis into information risks analysis step of the TIRM process. KARS method is used on material which comes from Borek et al. (2013). The authors identify 8 main sources of information risks. These 8 sources of information risks serve as dataset to be analysed using KARS. Each of the information risk sources is analysed. The information risk capability to activate other information risks, and its capability to be activated by other information risks are calculated.

KARS method enables managers to distinguish among identified risks those of primary and/or secondary importance, and which are relatively safe. Primary risks are “active” risks with a

high Coefficient of activity – KAR. Secondary risks are “passive” risks with a high Coefficient of passivity – KPR. Active risks are those which can activate a high percentage of all other risks within the predefined set of risks. Passive risks are those which are activated by a high percentage of all the other risks within the predefined set of risks. It is the percentage of other risks which defines the coefficients, e.g. KAR = 80 % means that related information risk can activate 80 % of other information risks within the defined set of 8 sources of information risks.

Focusing on active information risks then enables managers to detect initial phase of any undesirable crisis development which would result in a significant loss of assets. Detecting impacts of an active information risk gives early signal to managers before the negative consequences of an active information risk disseminate across the whole enterprise. Determining priority information risks should be a part of early warning system design in any enterprise.

## **4 RESULTS**

ESE can be undermined when internal or external influences in the form of risks and threats are transformed into negative impacts on enterprise assets. In order to avoid such implausible loss of asset value, enterprise risk management as a continuous process should be undertaken during the whole life cycle of an enterprise. Therefore, it is a permanent need for ESE to identify, analyse, evaluate, and subsequently treat risks which can take a serious impact on enterprise’s assets.

Not every impact of risk can be detected by a continuous enterprise risk management process. Therefore, priority risks should be determined and continuously observed. If the risks which could activate a high percentage of other risks, are selected as the priority risks, managers will be able to detect an early stage of undesirable evolution by observing signals of the priority risks.

### **4.1 Information risk identification – the dataset**

Information risks origin in not providing accurate information at right time, and in requested quality for business process. Borek et al. (2013, p. 60) define information risk as “the effect of uncertainty on an organization’s business objectives that arises from information quality.” The sources of information risk are related to poor data quality which can arise from: (a) different type of systems in use, (b) transfer of data between different (often incompatible) systems, (c) accidental/intentional removal of data, (d) improper data governance, (e) lack of responsibility and authority for managing data, (f) lack of awareness of value of information, (g) lack of integration between IT and business processes, (h) lack of training and motivation. These 8 sources of information risks as identified by Borek et al. (2013) as a dataset are further analysed by KARS method to develop deeper information risk analysis.

### **4.2 Information risk analysis – KARS analytical method**

Each enterprise must identify its specific information risks and then analyse, evaluate and treat them. Based on the 8 identified sources of information risks we analyse the interdependence of related risks using analytical method KARS. Completing the KARS table (Tab. 1) by ones or zeroes is based on considering any specific information risk coming from the row source of information risk with respect to its ability to activate another specific information risk which comes from the column source of information risk. When a given source of risk has a high percentage of ones in its row, then it has a higher coefficient of activity, KAR. When a given source of risk has a high percentage of ones in its column, then it has a higher coefficient of passivity, KPR.

Tab. 1 – KARS table – Information risk sources. Source: own research

		A	B	C	D	E	F	G	H	KAR (%)
Different type of systems in use	A	x	1	1	1	1	0	0	0	57,14
Transfer of data between different systems	B	1	x	0	1	1	0	0	0	42,86
Accidental/Intentional removal of data	C	0	0	x	0	0	1	0	0	14,29
Improper data governance	D	0	0	1	x	1	0	1	0	42,86
Lack of responsibility and authority for managing data	E	0	0	1	1	x	1	1	0	57,14
Lack of awareness of value of information	F	0	0	1	1	1	x	1	1	71,43
Lack of integration between IT and business processes	G	1	1	1	0	1	1	x	1	85,71
Lack of training and motivation	H	0	0	1	1	1	1	1	x	71,43
	<b>KPR (%)</b>	<b>28,57</b>	<b>28,57</b>	<b>85,71</b>	<b>71,43</b>	<b>85,71</b>	<b>57,14</b>	<b>57,14</b>	<b>28,57</b>	

Based on the calculated coefficients of activity and passivity, KAR and KPR, we can depict the information risk sources in the graphical representation in Fig.5.

The lines which divide the whole area into quadrants are calculated to cover a given percentage of risks by the I. quadrant, for example 60 or 80 %. The x-axis coordinate represents KAR in the number of percentages between 0 and 100, and the y-axis coordinate represents KPR of a given risk coming from the defined source of information risk. The base interpretation of position in the KARS graph is related to four quadrants: (a) primary and secondary dangerous risks (I. quadrant) activate a high percentage of other risks and they are also activated by a high percentage of other risks, (b) secondary dangerous risks (II. quadrant) do not activate many other risks but they are activated by a high percentage of risks, (c) primary dangerous risks (III. quadrant) activate a high percentage of other risks but they are not activated by many other risks, (d) relatively safe risks (IV. quadrant) are interdependent with other risk only at a minimum level.

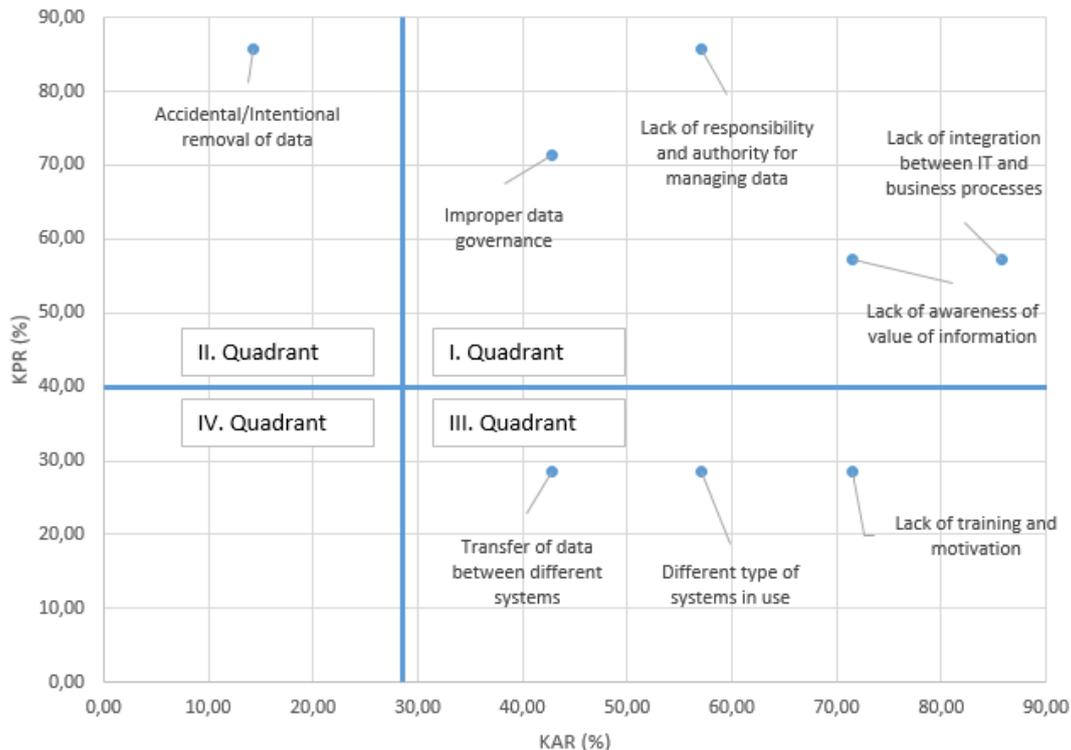


Fig. 5 – KARS of information risk sources. Source: own research

## 5 DISCUSSION

KARS analysis applied on information risk sources suggest that the primary and secondary dangerous risks stem from: (a) the lack of integration between IT and business processes, which activates about 86 % of other risks, and is activated by about 57 % of other risks, (b) the lack of awareness of value of information, which activates about 71 % of other risks, and is activated by about 57 % of other risks, (c) the lack of responsibility and authority for managing data, which activates slightly lower portion of other risks (57 %) but it is activated by the highest (86 %) portion of other risks, and (d) improper data governance, which activates about 43 % of other risks, and is activated by about 71 % of other risks.

Other primary risks which should be treated with high priority, because they can activate a high portion of other risks are: (a) the lack of training and motivation, which activates about 71 % of other risks, (b) different type of systems in use, which activates about 57 % of other risks, and (c) transfer of data between different systems, which activates about 43 % of other risks.

These results are in line with the theory of information value for businesses and the need for proper integration of enterprise information system with business processes. Therefore, an enterprise reaches a state of economic security in the area of information processing by promoting the perception of information value across the whole organization, and to design enterprise information system at the highest possible level of integration with business processes. Human resources should be well trained and highly motivated for the enterprise to succeed in securing high quality data and information, which are used along with the business processes. Omitting priority risks signals can lead to secondary dangerous impacts on the enterprise from the lack of responsibility and authority for managing data, improper data governance and accidental/intentional removal of data. It is worth to mention that the three sources of risk in III. quadrant: transfer of data between different systems, different type of systems in use and lack of training and motivation are rarely activated by information risks from other sources, but these three sources of information risks are capable of activating significant portion of information risks from other sources. Therefore, the risks from III. quadrant should be treated with high priority, too.

## 6 CONCLUSION

Information value is higher than the cost of information, and increases as enterprise information system integrates with business processes. The information value then disseminates across the whole enterprise for the benefit of stability and growth. Preserving information value is beneficial to ESE. The value of information is preserved by securing information and data quality by the means of proper information quality management. The quality of information must be considered in multidimensional framework, and in the context of related business processes based on the area of business processes as well as based on the level of management.

In the same manner as the benefits of information disseminate across the whole enterprise, also negative impacts of poor information and data quality spread among various related business processes. There are information risks related to poor data and information quality, which can reduce the information quality, and hence decrease the value of information to the enterprise. Crucial role of information as an asset to enterprise demands preservation of the information value through a continuous risk management process in order to maintain a high level of ESE. Information risk identification, information risk analysis, information risk evaluation, and information risk treatment should be continuously repeated in order to avoid negative impacts of information risks to the enterprise. The information risk management process then supports

managers with a set of identified relevant information risks to be further analyzed, evaluated and treated in order to prevent serious crisis of the enterprise performance.

KARS analysis of information risk sources showed that lack of integration between IT and business processes, and lack of awareness of value of information are primary and secondary dangerous sources of information risks to enterprise. Furthermore, the lack of responsibility and authority for managing data, and improper data governance as primary and secondary dangerous risks demand serious attention as they can activate and also can be activated by a high portion of other information risks. On one hand, if managers eventually omit signals of primary dangerous information risks impacts on the enterprise, the primary information risks activate other information risks, and magnify the effects of original primary dangerous risks. On the other hand, if managers observe signals of primary dangerous information risks impacts, they can take early actions to avoid spreading of negative impacts across the whole enterprise. Early action can be hardly taken when observing signals of secondary dangerous information risks impacts as they mean that already a high portion of primary dangerous information risks have been activated.

In conclusion, information risk management should concern with priority on integrating enterprise information system with business processes, and also on promoting awareness of information value across the whole organization as these sources of information risks can activate and can be activated by a high portion of other information risks. Early prevention can together with well trained and motivated human resources prevent enterprise to enter an acute crisis phase of its performance, and hence ensure high levels of ESE.

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# ENGAGING CONSUMERS IN THE SHARING ECONOMY: A PROPOSED EMPIRICAL STUDY FROM THE PERSPECTIVE OF AN EMERGING COUNTRY

*Mark Ratilla, Miloslava Chovancová*

## **Abstract**

The advances in technology along with the increasing consumption awareness of consumers have driven the growth of the sharing economy. This innovative business model allows faster communication and greater collaboration of sharing resources among people. Its conceivable disruption to existing conventional businesses and pro-environmental implications have caught the attention of various players from the industry, government and the academic sector as well. Likewise, this drew the attention of many consumers in different parts of the globe and fostered more usage over the years. Therefore, this paper primarily aims to explore the different factors influencing consumers participation in sharing economy from the academic literature and subsequently propose a research framework for future empirical investigation. A literature review involving content analysis was carried out to examine the existing account of related research from the Scopus and Web of Science databases. The review findings reveal that economic, hedonic, environmental and social benefits mainly motivate consumers to use products and services in the sharing economy. Meanwhile, lack of trust, perceived risk, lack of awareness and efficacy discouraged participation. However, these empirical findings were mainly gathered from consumers in developed countries despite the exponential growth of sharing economy businesses in developing or emerging countries. Thus, a conceptual study is proposed to be undertaken from the perspective of an emerging country. This will further offer comprehensive insights on the growing research area concerning the sharing economy.

**Keywords:** *collaborative consumption, behavioural antecedents, behavioural intentions, sharing economy, theory of planned behaviour*

## **1 INTRODUCTION**

The sharing economy is an innovative economic model that emerges from advances information technology and the growing consumption awareness of consumers. The internet and Web 2.0 hasten communication and offer greater collaboration opportunities between people (Belk, 2014). It was also noticed that consumers express added concern on its consumption habits and are exploring possibilities to utilize resources more efficiently following the global economic crisis (Jiang & Tian, 2018). All these revolutionize the old practice of sharing that were only limited to exchanges between family members or close peers.

Nowadays, people can easily share resources (i.e. physical or digital) among each other via internet-mediated platform with or without a fee. Many sharing economy firms have drawn the attention of many consumers and fostered more usage year by year. This is evident as sharing economy firms like Airbnb, CouchSurfing, Uber, Blablacar, Lyft, Wix, Spotify, SoundCloud and many others are becoming more popular and demonstrating successful operations globally. A study of PriceWaterhouseCoopers (2015) indicated that about 15 billion dollars were earned by sharing economy companies in 2013 and is projected to increase up to 335 billion dollars by 2025.

The rapid growth and increasing popularity of sharing economy models across different geographical locations deserve substantial attention. In order to support and boost its growth, it

is essential to gain deeper insights on consumers' experiences participating in the sharing economy. It is crucial to explore and understand consumers' motives and/or constraints in using these platforms in order for sharing economy firms to craft effective business strategies and redesign existing product and service offerings. Thus, this paper primarily explores the factors influencing consumers participation in sharing economy from the academic literature. Subsequently, a research model is proposed for future empirical investigation that will offer significant insights in the existing knowledge base about the sharing economy and consumer behaviour.

This paper is structured as follows: i) a brief review of the sharing economy concept, ii) methodology, iii) literature review results, iv) proposed research model, hypotheses and methodology, v) conclusion and implications.

## **2 LITERATURE REVIEW**

### **Conceptualizing the “sharing economy”**

The novelty and popularity of the “sharing economy” (SE) have driven several researchers to develop definitions of the concept. Codagnone & Martens (2016) assert the absence of a unified and/or established definition of the concept. Besides, it is currently concomitant to “collaborative consumption”, “access-based consumption” and “peer-to-peer sharing” (Wirtz et al., 2019). Frenken et al. (2014) point out that “sharing economy” focuses on giving temporary access of underutilized resources between the suppliers and users thru an IT platform with or without compensation. Collaborative consumption, on the other hand, involves sharing access of goods and services among peers through an online platform (Hamari et al., 2016). Renting, swapping, bartering or trading of goods, services and other underutilized resources encompasses collaborative consumption activities (Möhlmann, 2015). Also, the description of Tussyadiah (2016) about peer-to-peer (P2P) services closely adheres to the early sharing economy concept as it embroils sharing access of resources (e.g. spare bedroom or house) from ordinary individuals to their peers (e.g. tourist). Nevertheless, all these terms are profoundly entrenched on the phenomenon of “sharing” which involves the distribution of personally owned resources to other people (Belk, 2007).

Wirtz et al. (2019) accentuate that distinct to the sharing economy model is its emphasis on granting temporary access of resources possessed by people and platform providers. Frenken et al. (2014) observe that the sharing economy operates in C2C (consumer-to-consumer) or B2C (business-to-consumer) model (Figure 1). In a C2C model, the resources being shared are owned by consumers themselves. The exchange is facilitated via an IT platform that is established by a platform provider. Meanwhile, in a B2C model, the platform provider supplies the resources for customers to access for a fee. However, Böcker & Meelen (2017) argue that the B2C model does not define the sharing economy but rather access-based consumption or collaborative consumption. They specified that distinct to the sharing economy encompasses the provision of temporary access of idle resources only between the consumers (i.e. C2C). Eckhardt et al. (2019) indicate that “temporary access, transfer of economic value, platform mediation, expanded consumer role and crowd-sourced supply” are the key defining features of the sharing economy. Likewise, the proposed definition by Šiuškaitė et al. (2019) maintains that sharing economy enables the distribution of existing resources between peers and is facilitated by modern information technology.

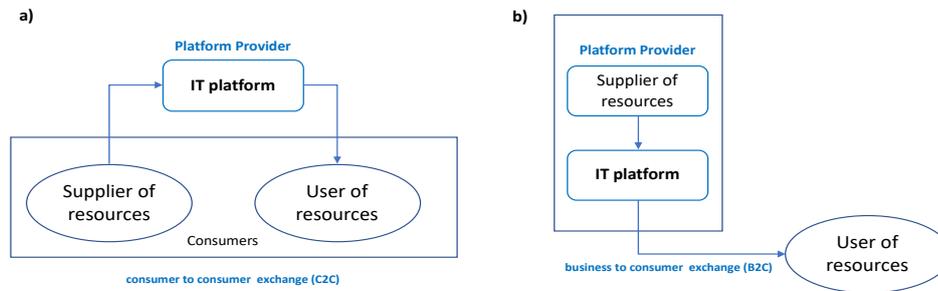


Fig. 1 – The sharing economy illustrated (a) C2C model & (b) B2C model. Source: Frenken et al., 2014

### Current developments in the sharing economy

Extant studies claim that this emerging business model disrupt conventional business models. Dogru et al. (2019) claim that shared accommodation services by Airbnb is disrupting the hotel industry. Based on their estimates, revenue loss could range from \$91 - \$365 million dollars in 2016 as a result of Airbnb operation specifically in New York City. This confirms the findings of Zervas et al. (2017) that hotel revenues in Texas are adversely affected by the presence of Airbnb as it provides authentic local accommodation experience to travellers, thus, putting low-end hotels at the disadvantage. Likewise, Yan et al. (2019) maintain that consumers’ desire to experience interaction with the local people and their cultures may cause them to move away from conventional hotel accommodation. Moreover, Roma et al. (2019) reported that Airbnb are affecting pricing decisions of hotels. Aside from these disruption claims, the increasing popularity of the sharing economy is deemed to be fuelled by its contribution to environmental sustainability. Its inclination towards access-based consumption and emphasis on efficient use of idle resources is a possible route towards achieving sustainable consumption and trim down environmental degradation (Zhu et al., 2018). Existing evidences on the environmental impacts of sharing economy in the literature is still represented by the mobility-sharing sector. Chen & Kockelman (2016) and Nijland & van Meerkerk (2017) claim that CO<sub>2</sub> emissions can be reduced through driving down car ownership and usage. Likewise, Hui et al. (2019) indicate that the existence of car sharing schemes can defer vehicle ownership especially for people frequently travelling by car and have greater experience in carsharing. Luna et al. (2020) also assert that CO<sub>2</sub> emissions can be reduced via e-carsharing as more people adopt electronic vehicles along and complimentary policies. Nevertheless, Jung & Koo (2018) contend that the advantages offered by mobility-sharing model could also induce consumers to travel more and increase its usage which correspondingly increase CO<sub>2</sub> emissions.

### 3 METHODOLOGY

A literature review following content analysis was carried out to explore the primary drivers and/or constraints of participation among consumers in the sharing economy in the academic literature. Extant studies focusing on the consumers’ behaviour in the sharing economy from Scopus and Web of science databases were explored and examined. Initially, keywords such as “sharing economy”, “collaborative consumption”, “attitude”, “intentions” were used for the literature search on the research databases. Due to the vast number of search results and the varying study contexts, the article selection was further confined based on the relevance in fulfilling the main objective of the paper. That is, selected articles should tackle motives/constraints shaping attitude, intention or behaviour to use products and services in the sharing economy. Further, highly cited research articles were chosen for full reading. Thus, a total of 28 sharing economy related articles from the Scopus and Web of Science databases were selected and examined after passing through the aforementioned selection criteria. Central to the analysis was to collate empirical evidences proving the association and/or interplay of

the identified factors towards behavioural outcomes and more importantly the corresponding research gaps. Consequently, all these were used as inputs to develop a research model for an empirical investigation in the future.

## 4 RESULTS

### **Key factors influencing consumers' sharing economy participation**

Findings from the literature review shows that a number of studies have investigated several motives and/or constraints for consumers to access product and services in the sharing economy. Thus, this section outlines the most common factors influencing consumers to use sharing economy products and services. The study findings reveal that leading motives include economic benefits, hedonic benefits, environmental and social benefits. Meanwhile, lack of trust, perceived risk and lack of awareness impede consumers' sharing economy participation.

*Economic motivation.* Extant studies reveal that consumers desire to access products and services in the sharing economy is primarily motivated by economic reasons. The model allows people to access resources which they couldn't afford (Belk, 2010; Hallem et al., 2019). For properties like cars and houses, enabling temporary access rather than full ownership of these assets may reduce costs associated with maintenance, usage, or storage. Moreover, affordability and better price of sharing economy offerings than conventional alternatives prompt participation among users (Lang, 2018; Z. W. Y. Lee et al., 2018; So et al., 2018; Tran & Filimonau, 2020). Böcker & Meelen (2017) found that these benefits especially attracted participation of low-income groups and younger generation.

*Hedonic motivation.* The feeling of pleasure, enjoyment and fun derived from the use of sharing economy products and services is found to stimulate participation among consumers (Hwang & Griffiths, 2017; Lang, 2018; Z. W. Y. Lee et al., 2018; So et al., 2018). The unique and the eccentric experience offered by sharing economy providers are perceived to be enjoyable and pleasurable. Airbnb hosts, for instance, in some way recede from providing conventional services that are provided in hotels. The offering of an authentic, unique and closer to local experience induces the feeling of pleasure and enjoyment among users (Tussyadiah & Pesonen, 2018). Nevertheless, the findings of Amirkieae & Evangelopoulos (2018) insinuate that the feeling of pleasure derived from socializing with other people (i.e. service providers) does not significantly influence intentions towards the use of ride sharing platforms.

*Environmental motivation.* The sharing economy is believed to promote the efficient utilization of resources, thus, may affect sustainable consumption. Extant studies have investigated whether consumers are participating in the sharing economy due to its leaning towards environmentally-sustainable practices. Results suggest that consumers' perceptions on the environmental sustainability implications of the sharing economy can positively influence their participation (Barnes & Mattsson, 2017; Böcker & Meelen, 2017; Hawlitschek, Notheisen, et al., 2018; Hawlitschek, Teubner, et al., 2018; Laurenti & Acuña, 2020). Wang et al. (2020) stipulate that the environmentally conscious individuals are more likely to in engage sharing economy services. On the contrary, Amirkieae & Evangelopoulos (2018) findings indicate that sustainability concerns among individuals does not have significant association on ridesharing participation. Likewise, Becker-Leifhold (2018) claims that environmental issues do not influence participation among consumers.

*Social benefits.* The opportunity to socialize, interact and build relationships with diverse people is another motive for consumers to use offerings in the sharing economy. Hawlitschek et al., (2018) acknowledge this as their findings show that social experience is significantly affecting behavioural intentions and remains to be one of the undisputed stimuli among users

to participate in the sharing economy. Moreover, the feeling of being part of a community and the social bonds created by helping each other through sharing resources urge consumers' intention to engage in the sharing economy (Albinsson et al., 2019; Belk, 2007; Hallem et al., 2019; Roos & Hahn, 2017; Tussyadiah & Pesonen, 2018). However, the findings So et al. (2018) negate the claim as they observe an increasing number of customers in peer-to-peer accommodation sharing opting to rent an entire house rather than living with the host to avoid possible social interaction.

*Social influence.* Consumers usually seek information prior eliciting a particular action. One important source of information can emanate from other people's opinion who may have prior experiences (i.e. word of mouth). Actions acceptable by the peers and/or the community enforces pressure to an individual to do the same (S. H. N. Lee & Chow, 2020). In the sharing economy context, the studies of Amaro et al. (2019), S. H. N. Lee & Chow (2020) and So et al. (2018) claim that consumers are influenced in the form recommendations from peers or other people

*Accessibility & Convenience.* Information technology has continuously provided innovative solutions to real world problems. The sharing economy emerges as a transformed version of a conventional form of sharing due to IT solutions. Sharing has become easier, faster and extensive. Boateng et al. (2019) findings suggest that consumers use of ride sharing services is proven to be driven by convenience. As most ride sharing services operate using mobile applications and internet connectivity, the time required to access these services is significantly reduced as compared to conventional alternatives (e.g. taxi). Moreover, the enhanced accessibility, flexibility and time-saving features provided foster the feeling of convenience among users (Chun et al., 2019; Hallem et al., 2019)

*Variety.* A variety of accommodation types are offered in peer-to-peer accommodation platforms particularly in Airbnb (Amaro et al., 2019). Accommodation service providers are increasingly offering more unique and localized experience to customers (Tussyadiah & Pesonen, 2018). Thus, the range of choices are available to customers from conventional to local houses, houseboats, tree houses, windmills, caves and many others. The empirical findings of Hawlitschek, Teubner, et al. (2018) suggest that the variety of products made available to consumers in peer-to-peer sharing platforms positively influence their usage. Similarly, in the fashion renting context, consumers are strongly attracted to the availability of fashion items in different styles and brands which are offered at affordable prices (Becker-Leifhold, 2018; Lang, 2018; S. H. N. Lee & Chow, 2020).

*Altruism.* Roos & Hahn (2019) claim that the intention to engage in collaborative consumption can be attributed consumers' altruistic values. This is to say that consumers who have great concern on the well-being of others are likely to develop positive intentions to use collaborative consumption platforms. This opposes the findings of Amirkiee & Evangelopoulos (2018) and Becker-Leifhold (2018) claiming that altruism does not drive intentions to participate in ride-sharing and fashion-renting, respectively.

*Trust.* Activities in the sharing economy is fundamentally entrenched on trust (Frenken et al., 2014). Amirkiee & Evangelopoulos (2018) also reveal that trust is a major factor to consider in the ride sharing context. They added that customers often seek the assurance of safety to increase their confidence in using the services. This is indeed the case as the use and provision of sharing economy offerings are extensively done online and in between strangers. Tussyadiah & Pesonen (2018) indicate that security and privacy issues on the use of the online platform can also affect consumers' trust. Citing a particular example, a customer who avails an accommodation sharing service can stay in a property alongside with the owner despite not having prior acquaintances. Also, security and privacy concerns arise as payment of the service

is usually done online and requires customers to provide personal information. Thus, there are two important contexts when we ponder on trust as an antecedent in the sharing economy participation. These involve trust on service provider and trust in the online sharing platform. Meanwhile, as services are listed online, customers heavily rely on photos, ratings, reviews and other virtual information to build their trust (Albinsson et al., 2019; Ert et al., 2016). Specifically, Lee et al. (2018) believes that incorporating trust building mechanisms especially in the online sharing platform enhances customers intention to participate as perception of risk is significantly reduced.

*Perceived risk.* Wang et al. (2020) specify that the security and privacy risk subsisting on the technology-driven sharing platform as well as on online transactions compel consumers to use ride sharing services. The authors added that safety in relation to the actual use of the products and services in the sharing economy is essential for consumers. These confirm Lee et al. (2018) findings revealing that perceived risk significantly restrain consumers' intentions to participate in ride sharing services of Uber. Conversely, Amaro et al. (2019) and So et al. (2018) ascertain the insignificant impact of perceived risk towards participation in the sharing economy. This is especially true to "millennials" since this particular generation is technologically-inclined and already have experience in executing online transactions (Amaro et al., 2019).

*Familiarity.* The sharing economy presents a new consumption alternative that strides away from the conventional ownership-based consumption. As a new model, it is believed that familiarity and awareness still remain low. Tussyadiah & Pesonen (2018) mentioned that many consumers are still unaware of accommodation sharing services. Besides, European Union (2018) reports only 23% of Europeans have accessed collaborative consumption platforms. Nevertheless, PriceWaterhouseCoopers (2015) forecast indicate a boost in participation in the next couple of years. Results of Hawlitschek et al. (2018) and Laurenti & Acuña (2020) suggest that consumers' awareness to the new economic model shapes their participation intentions. Likewise, Kim et al. (2018) stress that awareness of the consumption alternative poses a positive effect towards intentions to use sharing services as mediated by attitude.

*Efficacy.* Hallem et al. (2019) stipulate that some consumers may find it hard to use sharing economy platforms, particularly those who have insufficient knowledge on technological innovations. Individuals who are less likely to adopt new technologies may have less intentions to use sharing service (Wang et al., 2020). Also, the effort associated in setting-up an account and the ability to navigate the platform may be discomforting to some people (Hallem et al., 2019). However, Laurenti & Acuña (2020) oppose the findings asserting the use of sharing services does not demand much time and effort.

#### **4.2. Sharing economy platform and countries focused by extant SE-related studies**

Tab. 2 shows the different extant studies that particularly examine the behavioural antecedents in sharing economy participation. Evidently, most of these were published from 2016 to present. This implies that the concept is relatively young and its increasing popularity have captured the interest of various researchers. The investigation of Belk (2007) has pioneered discussions on the concept of sharing rather than ownership in the digital age. Eventually, as several businesses adopting the sharing economy model are emerging and thriving around the globe, more studies were carried out. Sharing economy providers in the accommodation (e.g. Airbnb) and ridesharing (e.g. Uber) sectors have undoubtedly demonstrating successful operations. Thereupon, most of the existing studies have focused on these sectors. Meanwhile, home products and fashion renting are seen to emerge. It is also apparent that most of the studies pay attention to consumers in first world countries as the sharing economy model is notably practiced.

Tab. 1 – Factors influencing of sharing economy participation based on extant studies. Source: own research

(Author, Year)	Motives / Constraints											
	ECO	HED	ENVI	SB	SI	CON	VAR	ALTR	TRU	PR	FAM	EFF
Belk (2007)	/			/				/				
Möhlmann (2015)	/		x	/					/		/	
Ert et al. (2016)									/			
Gullstrand Edbring et al. (2016)	/		/	/		/			/			
Hamari et al. (2016)	/	/	/									
Andreotti et al. (2017)	/	/										
Barnes & Mattsson (2017)	/	/	/	/								
Benoit et al. (2017)	/	/	/									
Böcker & Meelen (2017)	/		/									
Hwang & Griffiths (2017)	/	/	x									
Amirkiaee & Evangelopoulos (2018)	/	x	x	x		/		x	/			
Becker-Leifhold (2018)	x	/	x		/			x				
Kim et al. (2018)											/	
Lang (2018)		/	/							/		
Lee et al. (2018)	/	/							/	/		
So et al. (2018)	/	/			/				/	x	x	
Tussyadiah & Pesonen (2018)	/		/						/		/	
Hawlitschek et al. (2018)	/		/	/			/		/	/	/	
Albinsson et al. (2019)		/	/						/			
Amaro et al. (2019)	/				/		/			x		
Boateng et al. (2019)	/					/			/			
Chun et al. (2019)	/					/				/		
Roos & Hahn (2019)	/		/	/				/				
Hallem et al. (2019)			/			/			/			/
Wang et al. (2020)	/		/			/				/		/
Laurenti & Acuña (2020)	x		/	/			/		/	/	/	x
Tran & Filimonau (2020)	/		x	x					/	/	/	
S. H. N. Lee & Chow (2020)	/		/		/	/						

[ / - supported, x – not supported ] **ECO** (Economic, financial, utilitarian, cost saving benefits), **HED** (Hedonic, enjoyment, fun, pleasure motivations), **ENVI** (Environmental benefits), **SB** (Social benefits/ community belongingness), **SI** (Social/ Interpersonal influence), **CON** (Convenience/ Accessibility), **VAR** (Variety), **ALTR** (Altruism), **TRU** (Trust), **PR** (Perceived Risk), **FAM** (Lack of Familiarity/Awareness), **EFF** (Efficacy/ capability/ effort expectancy)

## 5 PROPOSED RESEARCH FRAMEWORK

The literature analysis reveals that sharing economy related studies have primarily concentrated on consumer behaviour in developed countries. Yet, sharing economy platforms are already spreading and thriving in developing or emerging countries. Thus, this paper presents a possible area for future empirical study to verify whether the previously identified antecedents hold true in a developing or emerging country. This means that the study primarily aims to strengthen and cross-validate findings from extant studies.

The proposed study will be founded upon the theory of planned behaviour (TPB) by Ajzen (1991). It is the extension of the theory of reasoned action (TRA) initially proposed by Ajzen and Fishbein (1980). The early findings of Taylor & Todd (1995) claim that the theory is more robust in explaining intention and actual IT usage. With this, more empirical investigations have used this theory to predict human social behaviour in varying situations. The theory specifies that the performance of actual behaviour is induced by attitude, subjective norms and perceived behavioural control via behavioural intentions. Based on the definition provided by Ajzen (1991), “*attitude refers to the degree to which a person has a favourable or unfavourable*

*evaluation of particular behaviour; subjective norm pertains to the perceived social influences in performing the behaviour; and perceived behavioural control refers to the a person's perception on the ease or difficulty of performing the behaviour” (p.188). He added that attitude, subjective norm and perceived behavioural control are shaped by behavioural beliefs, normative beliefs and control beliefs, respectively. Therefore, drawing upon the results of the literature review and the designated theoretical basis, hypotheses are proposed and a conceptual model is developed for future research undertaking (Fig. 2).*

Tab. 2 – Type of platform and country focused by previous SE studies. Source: own research

(Author, Year)	SE Platform	Country of Focus
Belk (2007)	General	()
Möhlmann (2015)	Car & Accommodation	Germany
Ert et al. (2016)	Accommodation	USA & Canada
Gullstrand Edbring et al. (2016)	Home products	Sweden
Hamari et al. (2016)	General CC	Finland
Andreotti et al. (2017)	Car & Accommodation	Denmark, France, Italy, Ireland, Germany, Poland, UK, Netherlands, Norway, Portugal, Spain, Switzerland
Barnes & Mattsson (2017)	Car sharing	Denmark
Benoit et al. (2017)	General CC	()
Böcker & Meelen (2017)	Multi-platform examination	Netherlands
Hwang & Griffiths (2017)	Car sharing	USA
Amirkiaee & Evangelopoulos (2018)	Car sharing	USA
Becker-Leifhold (2018)	Fashion renting	Germany
Kim et al. (2018)	General SE	South Korea
Lang (2018)	Fashion renting	USA
Lee et al. (2018)	Car sharing	Hong Kong
So et al. (2018)	Accommodation	USA
Tussyadiah & Pesonen (2018)	Accommodation	USA & Finland
Hawlitschek et al. (2018)	PPS in general	Germany
Albinsson et al. (2019)	Multiplatform examination	USA & India
Amaro et al. (2019)	Accommodation	Germany & China
Boateng et al. (2019)	Car sharing	Ghana
Chun et al. (2019)	Car sharing	Indonesia
Roos & Hahn (2019)	General CC	Germany
Hallem et al. (2019)	General CC	France
Wang et al. (2020)	Car sharing	China
Laurenti & Acuña (2020)	Multi-platform examination	Sweden
Tran & Filimonau (2020)	Accommodation	Vietnam
S. H. N. Lee & Chow (2020)	Fashion renting	USA

() – not specified [SE – sharing economy, CC – collaborative consumption, PPS – peer-to-peer sharing]

The proposed study will be conducted in the Philippines. A survey conducted by Nielsen (2014) shows that Filipinos rank 4th among the ASEAN nationalities that express high intentions to participate in the collaborative economy. Accordingly, SE platforms in the country are thriving and is mostly represented by the transportation (Grab) and accommodation (Airbnb) sectors. Notably, there is a limited number of sharing economy related studies focusing in developing countries, particularly the Philippines. Thus, as a response to extant studies' call for further investigation of sharing economy behaviour in countries exemplifying different socio-economic and cultural setting, the proposed study will be able to strengthen and validate previous findings. In addition, the study will provide significant insights to SE firms and providers in the Philippines as to how to boost the participation of consumers on the use of sharing economy products/services.

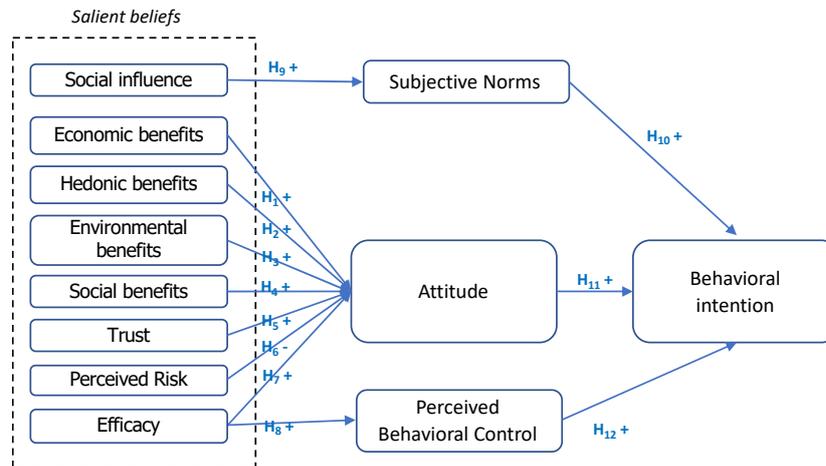


Fig. 2 – Proposed conceptual model. Source: own research

**Hypotheses (Figure 2): (in the sharing economy context)**

- H1: Economic benefits positively influence attitude
- H2: Hedonic benefits positively influence attitude
- H3: Environmental benefits positively influence attitude
- H4: Social benefits positively influence attitude
- H5: Trust positively influence attitude
- H6: Perceived risk negatively influence attitude
- H7: Efficacy positively influence attitude
- H8: Efficacy positively influence perceived behavioural control
- H9: Social influence positively influence subjective norms
- H10: Subjective norms positively influence behavioural intention
- H11: Attitude positively influence behavioural intention
- H12: Perceived behavioural control influences behavioural intention

The study will primarily employ quantitative research design. An online survey utilizing quota sampling method will be carried out among “millennial” generation. Quota sampling is a non-probability sampling procedure that ensures that the sample represents certain characteristics of the population. Thus, the study will espouse the definition of millennials as “a person born within 1981 and 1996”, as specified by Pew Research Center (2020). Činjurević et al. (2019) found out a significant involvement of millennials in sharing economy related activities. (Hwang & Griffiths, 2017) also assert that millennials are spurring up the growth of the sharing economy as this generational cohort grew up in era of information and communication technology advancement.

A survey questionnaire will be drafted to capture data on the constructs proposed in the conceptual model. All constructs will be operationalized by adopting validated measurement items from extant studies. Pretesting the questionnaire will follow to check the survey’s readability, clarity and its ease of completion. Modifications will be done if the pre-test results suggest so. Consequently, online survey links will be disseminated via mail or social media accounts to local collaborators in the study site. Then, structural equation modelling (SEM) will be employed for data analysis. SEM is a second-generation multivariate statistical method that allows the examination of measured and latent variables (Hair, 2017). Meanwhile, the sample size shall be determined based on the ratio of “five cases per observed variable” in the structural model (Bentler & Chou, 1987; Hamari et al., 2016). Therefore, if each construct in the proposed study will be measured by four measurement items, the target sample size threshold should be at least 320 respondents (= 16 constructs x 4 measurement items x 5 cases).

Furthermore, the following steps will be conducted prior the evaluation of the structural model using SPSS or SmartPLS statistical software.

Reliability and validity test: *Cronbach's alpha* (exceed 0.5), *composite reliability* (exceeds 0.7), *factor loading* (exceeds 0.40,  $p < 0.001$ ) & *average variance extracted* (exceed 0.5) (Fornell & Larcker, 1981; Hair, 2017). Fornell & Larcker (1981) guideline on discriminant validity postulates that the square root of average variance extracted should be larger than the correlation coefficients between latent variables. Collinearity checks: *Variance inflation factor* (VIF) values should be less than 5 to confirm the absence of collinearity issues (Hair, 2017).

## **6 CONCLUSION, IMPLICATIONS AND RESEARCH DIRECTIONS**

This paper primarily carried-out a review of empirical studies focusing on the different motives and/or constraints for consumers to use products and services in the sharing economy from the academic literature. Subsequently, the review findings were used to develop a conceptual model for an empirical study in the future.

The review reveals that economic benefits, hedonic benefits, environmental benefits, social benefits, social influence, convenience, variety, altruism, trust, perceived risk, familiarity and efficacy are the main antecedents of sharing economy participation. Evidence suggest that the level of influence of these factors towards behavioural outcome varies across sharing economy platforms and population. Furthermore, these studies have mainly focused on accommodation and ride sharing sectors in developed countries which seems to be valid as these sectors are demonstrating successful operations on these countries. Nevertheless, sharing economy businesses in a developing country is already thriving. These findings offer insights on the current developments and gaps in the sharing economy literature, specifically on understanding the behaviour of consumers. Thus, further research investigations can be carried out to provide more robust structure and comprehensively understand the sharing economy phenomenon including the behaviour of its intended consumers. This is also equally useful for sharing economy providers as they consider the identified influencing factors in the design of business strategies and accordingly enhance the engagement of consumers.

The absence of empirical investigation of consumers' sharing economy behaviour in the developing countries is a significant opportunity for future research. Thus, this paper proposes a study to investigate the factors influencing Filipino consumers' usage of sharing economy products/service. It will be founded upon the Theory of Planned Behaviour (Ajzen, 1991) and will mainly employ a quantitative research design. Specifically, structural equation modelling (SEM) will be used for data analysis. Possible practical contributions will not only support sharing economy firms and providers by providing insights to improve their existing offerings but also inform regulatory bodies in crafting effective policies. Most importantly, the proposed study will provide additional understanding on the existing consumer behaviour theory (i.e. Theory of Planned Behaviour) by considering the identified antecedents as salient belief factors that may shape the attitude, subjective norm and perceived behavioural control among consumers. This research initiative will thereby strengthen and validate extant findings.

This study is not without limitations. Primarily, the number of selected articles is not as exhaustive to represent the entirety of the sharing economy literature. Thus, more research articles should be included in the review and a more advanced literature review process should be adopted. Moreover, the proposed empirical model remains to be tested in future research investigations and researchers may introduce other influencing factors. Thus, the study encourages researchers to carry-out actual investigation and empirically test the proposed research model to contribute further insights in the sharing economy literature.

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# RESHUFFLING & REHANDLING OF CONTAINERS DURING STORAGE AND RETRIEVAL: A SYSTEMATIC LITERATURE REVIEW

*Mohan Saini, Tone Lerher*

## **Abstract**

Container reshuffle and rehandle is an inevitable process while storing and stacking inbound and outbound containers. Operational challenges due to the complex movement arising out of irregular and unscheduled demand and multiple tier stacking poses various cost and inefficiency challenges for yard operations. In this paper, literature review for various container reshuffling and rehandling research is studied to identify and to analyse the models researched for addressing container reshuffle process. Major container terminal operators, globally catering to multi terminal operations. Various strategies to stack containers for minimal container rehandle have been studied in the research community. An increasing number of research studies have been conducted in recent years, few studies have summarized the research findings and indicated the directions for future research regarding container reshuffle. This paper provides a systemic literature review of container reshuffle and rehandle at yard by examining 23 scientific journal papers listed in Scopus and web of science database in order to illustrate on various strategic objectives studied in container reshuffle and rehandling process. Based on the analysis of the literature review, various research gaps have been found. For example, differentiating layout strategies in concurrence with vessel stowage plan, vessel stability, exploring dynamic storage policies, multi data variant methods to curb reshuffling and rehandling.

*Keywords: Container Terminals, Container Storage and Retrieval, Container Stacking, Reshuffle, Rehandling, Container Relocation, Literature Review*

## **1 INTRODUCTION**

International world trade heavily relies on logistics focussing on marine mode of transportation. Approximately 80% of the volume of international trade, and 70% of the value, is moved by vessel and operated through the maritime ports distributed throughout the world (Muñuzuri et al., 2020; UNCTAD, n.d.) and the percentage is even higher for most developing countries.

This paper reviews the literature study for container relocation problem in a container terminal operation. A systematic study for container relocation problem with various solutions and research gap is studied for the purpose of summarization and review. Section I comprises of introduction along with the search strategy and problem definition identified through various literature reviews. Section II details the literature review along with the solution proposed by various papers. Section III discusses about the various methodologies adopted in the research. Section IV shared the results and findings of various container reshuffling strategies parameters. Sector V discusses the results along with future areas as defined in literature and authors future research area. Lastly, section VI shared the conclusion.

We will be reviewing various variables considered in a container terminal operation to reduce the rehandle per container. In order to evaluate the same, various terminologies in a container terminal are studied for understanding the detailed scope of container terminal operations.

## Container Terminal Operator

In general terms, container terminals can be described as open systems of material flow with two external interfaces. These interfaces are the quayside with loading and unloading of ships, and the landside where containers are loaded and unloaded on/off trucks and trains. Containers are stored in stacks thus facilitating the decoupling of quayside and landside operation (Steenken, Voß, & Stahlbock, 2004). Fig. 1 depicts the scheme of a container terminal operator.

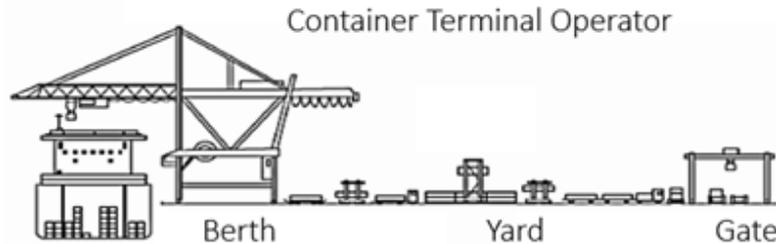


Fig. 1 – Container Terminal. Source: own research

In processing the containers while allocating yard storage location, operator organizes each section of storage and retrieval into various blocks. Fig. 2 illustrates the detailed plan of typical yard layout. A block can be described as basic unit of storage space for a group of containers. Every block with specific length and breadth has defined bays which is equivalent to the number of containers which can be stacked.

Multi-level stacking is one of the storage solutions which is practiced by terminal operators to manage the paucity of storage capacity. However higher stacking requires a greater number of rehandling and shuffles which has an added burden to the operational cost along with extra time to operate leading to congestion for container awaiting storage and retrieval. Serban and Carp (2017) defined a residence time-based strategy for stacking the containers in the right priority order, i.e. no lower priority container is placed upon a higher priority container.

Storage and stack planning are an important part of operational planning to manage the yard efficiently, and reduce the turnaround time of vessels and transportation, thus supporting in reducing the handling cost of yard cranes during container delivery. Fig. 2 depicts a container yard layout with positions of sea side and land side.



Fig. 2 – Container Yard Layout. Source: Sauri & Martin (2011)

The yard consists of many blocks each one of them having bays with fixed set of rows and each row having stacks of containers, which consists of a set of tiers, usually 4 or 5 (Fig. 3).

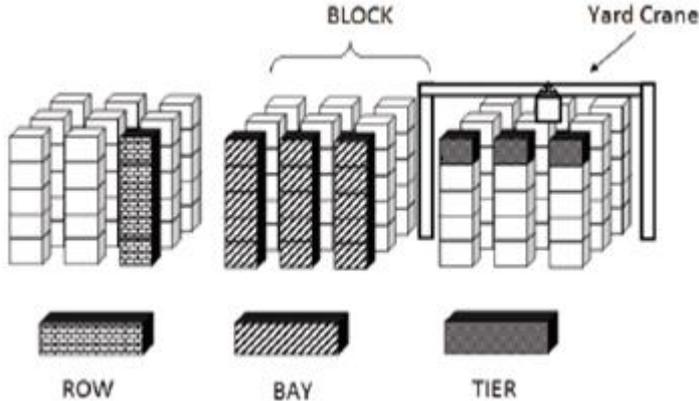


Fig. 3 – Container Yard Layout. Source: Serban & Carp (2017)

Quay crane functions from the place of vessel berthing by lifting the container and transferring it to the allocated slot in the block on a truck though rail mounted gantry cranes (RMG). The loaded truck transports the container to the unloading point through a yard crane RMG, which has a pre-allocated row of a bay in a particular bock for the placement of the container.

**Research Variables**

Literature review covers eight types of factors that could affect the reshuffle or rehandle at yard or vessel side and have been discussed widely in the literature reviewed: vessel berthing, stowage plan, vessel stability, crane operations, reshuffle at vessel, storage policies along with arrival and departure information. The authors considered that the above factors are contributing in single or multiple ways to cause the reshuffle and rehandle at yard, including the handling capacity and efficiency among these terminals. Below factors in respective frequencies along with operation plan-based inefficiency factor causes such un productive move.

Fig. 4 depicts the various variables which have been studied in the literature review for addressing the challenge of reshuffle and rehandling of containers.

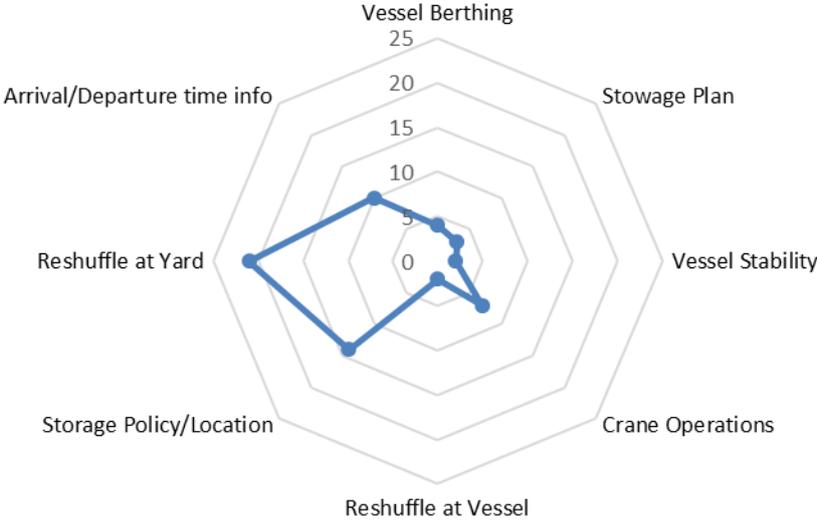


Fig. 4 – Research Variables of Literature Review. Source: own research

## 2 LITERATURE REVIEW

An unproductive move of a container, performed to reach another container stored underneath, is called reshuffling or rehandling. The objective in container stacking problem is to minimise the number of reshuffles, thereby increasing the efficiency of terminal operations (Güven & Türsel Eliiyi, 2019). An overview of reshuffling scenario in container operations yard is shown in Fig. 5.

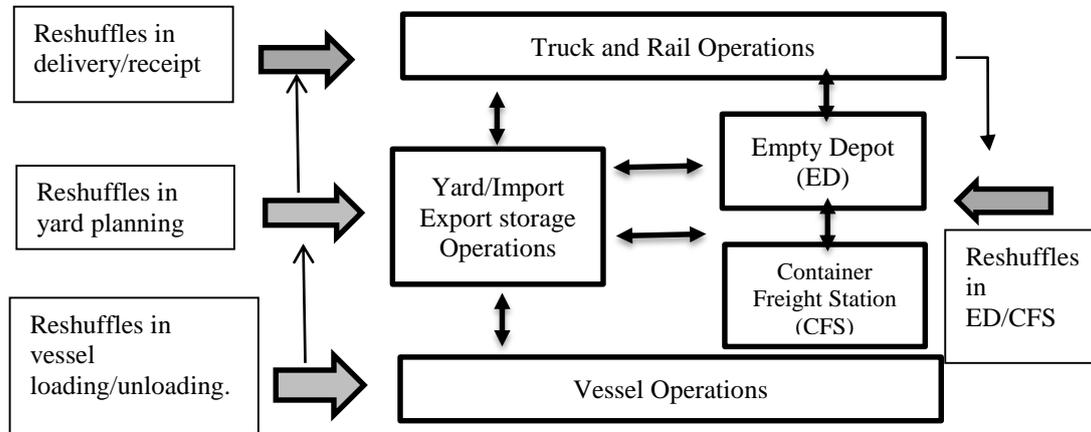


Fig. 5 – Reshuffling Scenario. Source: own research

Reshuffling is a perennial problem which occurs from vessel to vessel, port to port and container yard to another container yard. Due to the complex movement of containers across supply chain and space saving strategies of stakeholders allowing them to be stacked up to 4 or 6 tiers. It becomes important to develop models to minimize these reshuffles, as these cost additional strain to unwanted movements and time loss. Container terminal operations operates on two important parameters viz. faster turnaround time of vessels and least dwell time of containers in yard. Both these parameters are stiffly competitive in multiple terminal operator ports; hence it becomes imperative to study and research on this recurring problem at container yard. A detailed categorical problem definition overview is given in Appendix I.

Imai et al. (2006) researched upon the container stowage plan focussing towards reducing the container reshuffles. Han et al. (2008) emphasized on the important of storage locations of incoming containers with the minimal usage of yard cranes to curd rehandling in yards. Wan, Liu and Tsai (2009) proved through mixed integer programming using multiple heuristics on assignment of storage locations to minimize these shuffles.

Meisel and Wichmann (2010) concluded through a set of models and heuristics that internal reshuffles in the vessel leads to a shortening of vessel handling times utilizing integrated stowage planning and operations planning. Borgman, van Asperen and Dekker (2010) developed online rules for container stacking utilizing container departure time and the proximity of storing containers to the entry and exit points. Zhao and Goodchild (2010) further related this stacking process to truck arrival and departure time to reduce the reshuffles occurring in the yard.

Salido, Rodriguez-Molins and Barber (2011) integrated the problem of berth allocation and container stacking using multistart method to solve combinational optimization problem. The relationship between berth allocation for container stacking was developed using heuristics. Guldogan (2011) researched on different storage policies fir quay crane efficiencies and a simulation model to evaluate the performance of the container terminal. Rodriguez-Molins, Salido and Barber (2012) researched upon domain dependent heuristics for develop an AI based technique for solving container stacking problem for a set of outgoing containers. Jiang et al.

(2013) proposed a flexible space sharing strategy to consider uncertainties and possible integrate mode with the real time operations for controlling rehandling. Gharehgozli et al. (2014) modelled a decision tree-based heuristic to conclude that shared stacking policies re significantly outperforming the dedicated stacking policies. A stochastic dynamic programming model was developed using decision tree heuristics for developing new stacking policies to solve large scale reshuffling problems. Liu et al. (2015) modelled a polynomial time heuristics model for internal reshuffling which can complement double quay crane techniques to improve efficiency at a very low cost. Tang et al. (2015) the earlier model (MRIP) by removing column relationship variables and develop a new heuristic to rationalize static and dynamic reshuffling. Ahmt et al. (2016) develop a modified CPPTz model by modelling as a new approach to container positioning problem. A mixed integer programming on the model of just in time along with rolling time horizon worked upon reducing reshuffling for containers. Ku and Arthanari (2016) emphasized on truck appointment system using stochastic dynamic programming to conclude that estimates reshuffling index is a better method over random selection method with in a time window. Zhang and Lee (2016) compared ship stowage plan considering its stability and internal reshuffles. Gharehgozli, Mileski and Duru (2017) developed another model based on heuristics to estimate the estimate reshuffling derived from historical models focussing on three specific variables Probability of delay, Reshuffles given delay and Call size at delay.

Serban and Carp (2017) prioritized the containers based on low and high priority for stacking and managing reshuffles. The proposed layout prioritized the containers to reduce containers reshuffles and time spent by the vessels. Guerra-Olivares et al. (2018) analysed the strategy based upon sequencing of containers related to the number of tiers, weight and permitted bay utilization, this led to the conclusion that horizontal based strategies are better than vertical for monitoring reshuffles. Scholl, Boywitz and Boysen (2018) determined the schedule containers moves to minimize relocation moves. Guerra-Olivares, Smith, González-Ramírez, García-Mendoza and Cárdenas-Barrón (2018) developed a mathematical model with a dynamic version of heuristics to obtain a lower bound for the number of rehandle movements given the arrival sequence of container data. Güven and Türsel Eliiyi (2019) evaluated the efficiency of the storage yard to an optimal online assignment of incoming export transit or import or empty containers. He, Wang and Su (2019) calculated the impact of incomplete vessel information on container stacking and concluded that there is a dependency on the vessel information on reshuffles. Information divided into little moderated and high levels along with variety of scenarios explored upon the effect of incomplete information on container stacking.

### 3 METHODOLOGY

#### Search Process

To review the literature for container reshuffling and container rehandling, a search for journal articles that have been published in scientific journals in Scopus and Web of science (WoS) database was performed. To ensure the specificity of the search (Tab. 1), combinations of search strings such as “Container” And “Reshuffle”, “Container” And “Rehandling” were used to identify relevant research and the search field was set as title, keywords, and abstract.

Tab. 1 – Search strings, data base and results. Source: own research

Keywords	Database	Number of search results	Duplicates removed	Title and Abstract	Final Selection
Container and Reshuffle	WoS	38	47	19	23
	Scopus	33			
Container and Rehandle	WoS	4	4	4	
	Scopus	4			

The search was conducted in June 2020 and 79 papers were extracted from the data base. After removing the duplicates 51 papers remained. Then, a detailed and thorough review for title and abstract was checked for further refining the literature review of papers to 23. A detailed year wise break up is given below in Fig. 6 for the above given searched keywords.

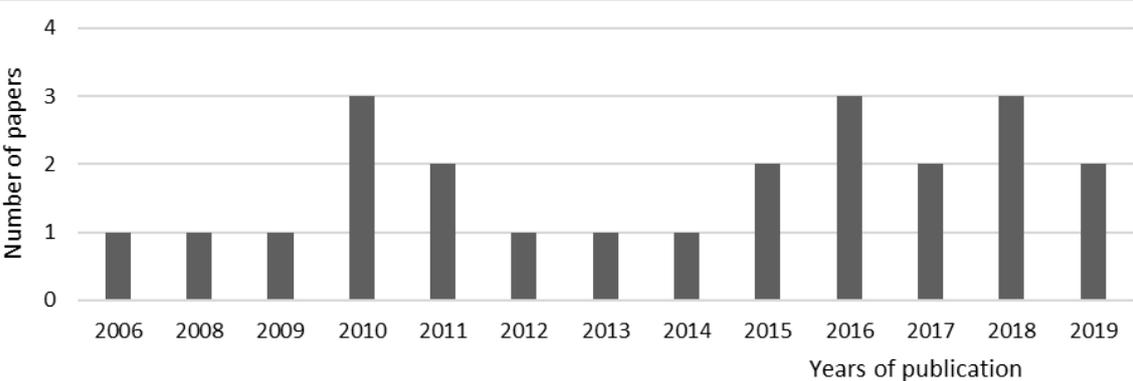


Fig. 6 – Distribution of journal paper by year of publication in Scopus database. Source: own research

### 4 RESULTS

A rehandle occurs at the multiple stage of container logistics and problem need to be addressed while managing the vessel berthing, vessel unloading, quay cranes operations, reshuffles at yard and subsequent depots along with the space storage policies and other operational costs. Fig. 7, depicts the various solution approached as designed and discussed in the literature review. Author has considered to review the second and third most variable studied along with reshuffle at yard to understand and build a model for future research. It has been observed from appendix I that storage policies (13 times) along with advance planning information like arrival and departure (10 times) have been studied in minimizing the reshuffle and rehandle at yard.

During this transaction cycle, a container is transacted between different sources and stakeholders for managing its movement. Every movement has an associated cost and efficiency related to it. Thus, it becomes imperative to control this cost and management movement on the basis of integrated movements based on data sharing policies.

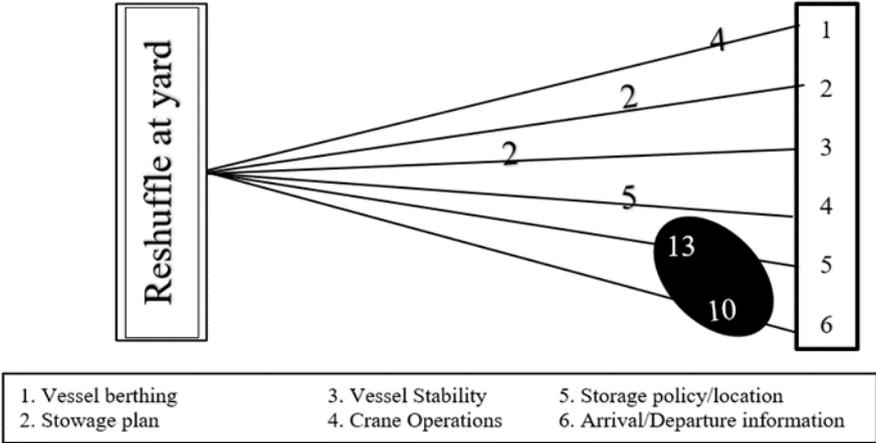


Fig. 7 – Relational comparison of reshuffle at yard with other variables. Source: own research

Majority of the research studies have utilized the mathematical and integer programming model to develop strategies for minimizing container reshuffle and rehandle.

## 5 DISCUSSION

The responsibilities of terminal operators are towards reducing the inefficient times in order to improve the dwell time and vessel turnaround time. Container terminal operations can be managed efficiency by reducing inefficiencies in the container movement. This specific inefficiency of container reshuffling is solved in research by primarily using mathematical models and heuristics. As illustrated in Fig. 8, these models play a significant role in reducing the reshuffles while determining the network layout along with other factors of arrival departure information and storage policies. It is also suggested to explore the possibility of resolving this challenge by latest technologies like artificial intelligence for development of model to optimize and predict moves per container.

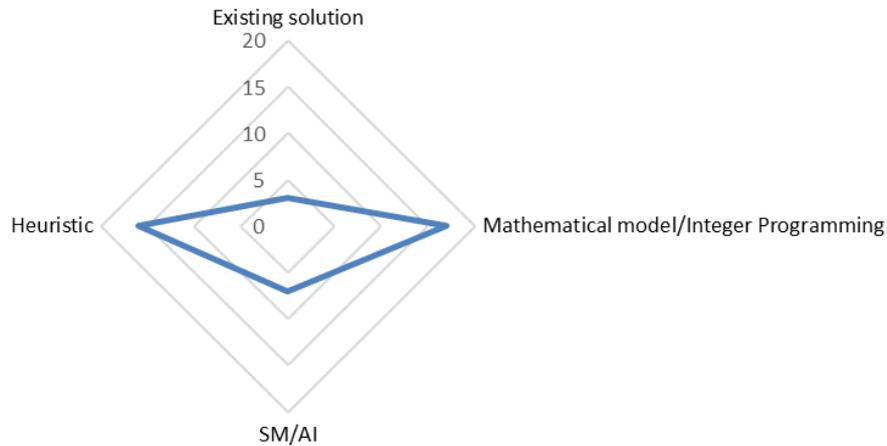
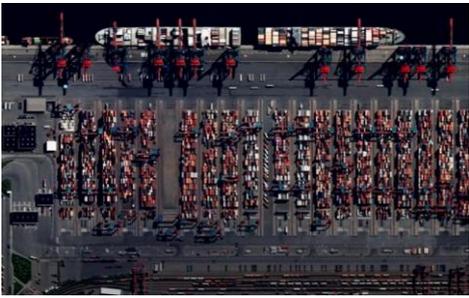


Fig. 8 – Solution approach. Source: own research

### Literature future research area

Tab. 2 depicts the summary of future research area as discussed in literature review. They review varied situation from vessel operation area to yard operation area as a scope for research.

Tab. 2 – Future research area as per container area specification. Source: own research

	<p style="text-align: center;"><b>Ship Operation Area</b></p> <ol style="list-style-type: none"> <li>1) Data driven methods and complex algorithms using metaheuristics.</li> <li>2) Extensions to ship stowage plans.</li> <li>3) Integrated system for quay crane allocation with berth allocation problem and container stacking allocation.</li> <li>4) Variability like vessel with multiple port of destination, a greater number of vessels, and loading with multiple quay cranes.</li> </ol>
<p><b>Yard Operations and Inland Transportation</b></p> <ol style="list-style-type: none"> <li>1) Layout differentiation with different material handling equipment's.</li> <li>2) Dynamic stacking algorithms using different material handling equipment's.</li> <li>3) Dynamic storage strategy for traffic congestion.</li> <li>4) Researching on un-certainty in container stacking along with integrating planning model with real time operations.</li> </ol>	

## Author future research area

Controlling reshuffles using common single platform solution for multi terminal network is to be evaluated for collaborative work. As per Fig. 6, this reshuffling is a recurring challenge at every step of container movement which is terminal, transportation, vessel loading and unloading, study will be conducted of developing a common single independent solution to control the reshuffles which pass from one movement to the other using soft computing techniques. It is important to perform one critical methodology review for reshuffling and rehandling in containers. As per Fig. 5, most of the researchers have researched upon modelling utilizing storage and stacking policies along with arrival departure information. This it becomes imperative to research upon single information system important from data sharing perspective to relate information and optimize operations. Different variables such as container consignee, historical clearance time, container locational operator dwell time will be utilized to develop a predictive model for allocation of stacking location (Fig. 9).

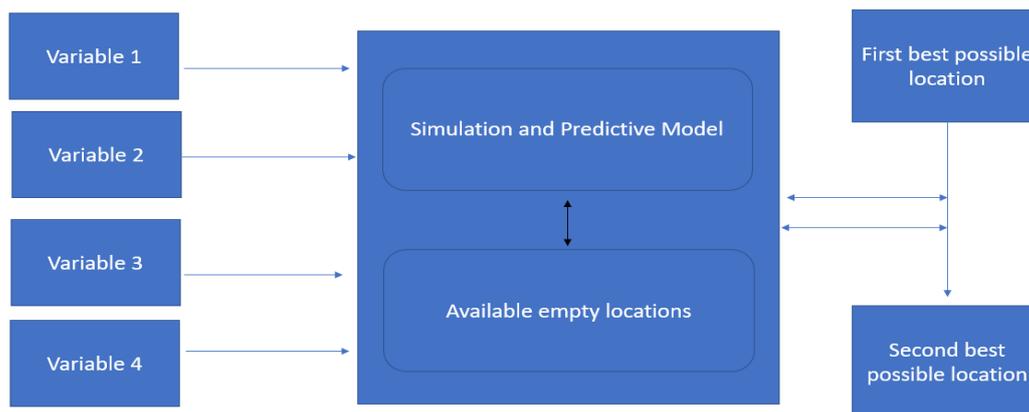


Fig. 9 – Framework for reshuffle at yard with advance planning model. Source: own research

## 6 CONCLUSION

This paper reviews container reshuffling and rehandling in the vessel operation area, yard operation area and truck or train operation area. Based on the 23 papers, we can find that the number of studies on container reshuffling is relatively small but increases in the last years. Meanwhile, the academic community pays special attention to the container handling and reshuffling from the object of port efficiency and vessel turnaround time. Along with various mathematical, simulation and heuristics model it is derived that substantial amount of container handling can be controlled by controlling various parameters like vessel arrival information, utilizing multiply quay cranes with static and dynamic functioning. Special discussion has been given to yard management issues while delivering the container at customer side using truck arrival information. It is evident to conclude that reshuffling is a multi-stakeholder-oriented challenge and should be addressed with common single platform with data driven algorithms for minimizing container rehandling.

As for the methodologies used in the articles, mathematical modelling and simulation tools are widely used to find the optimal reshuffles. Heuristics modelling have been used in multiple researches to investigate the relationship between reshuffling and material handling equipment efficiency in coordination with port operations.

Future research, should include advance technologies for planning the information in advance for arrival and departure in sync with the stacking policies. This will yield in optimizing the process and predicting the unwanted moves well in advance to the actual occurrence.

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## APPENDIX I

Authors	Problem Definition/Research Variables								Solution Approach			
	1	2	3	4	5	6	7	8	9	10	11	12
Imai et al. (2006)		*	*				*			*		
Han et al. (2008)						*	*	*	*	*		
Wan, Liu & Tsai (2009)						*	*			*		*
Meisel & Wichmann (2010)		*		*	*					*		*
Borgman, van Asperen & Dekker (2010)						*	*	*			*	
Zhao & Goodchild (2010)							*	*			*	
Salido, Rodriguez-Molins & Barber (2011)	*						*				*	*
Guldogan (2011)	*			*		*	*	*			*	
Rodriguez-Molins, Salido & Barber (2012)						*	*				*	*
Jiang et al. (2013)						*	*			*		*
Gharehgozli et al. (2014)						*	*		*	*		*
Liu et al. (2015)				*	*	*				*		*
Tang et al. (2015)				*		*	*	*			*	*
Ahmt et al. (2016)				*			*	*		*		*
Ku & Arthanari (2016)							*	*		*		*
Zhang & Lee (2016)		*	*				*			*		
Gharehgozli, Mileski & Duru (2017)	*						*			*		*
Serban & Capr (2017)						*	*	*		*		*
Guerra-Olivares et al. (2018)						*	*		*	*		*
Scholl, Boywitz & Boysen (2018)				*		*	*			*		*
Guerra-Olivares et al. (2018)				*		*	*			*		*
Güven & Türsel Eliiyi (2019)						*	*	*		*	*	
He, Wang & Su (2019)	*						*	*		*		*

### Problem Definition

- 1: Vessel Berthing
- 2: Stowage Plan
- 3: Vessel Stability
- 4: Crane Operations
- 5: Reshuffle in vessel
- 6: Storage Policy/Stacking Location
- 7: Reshuffle at yard
- 8: Arrival/Departure Information

### Solution Approach

- 9: Existing solution modification
- 10: Mathematical modelling/Integer programming
- 11: Simulation modelling/Artificial Intelligence
- 12: Heuristics

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# APPLICATION OF ARMA AND GARCH MODELS ON TIME SERIES OF KOMERČNÍ BANKA STOCKS

*Markéta Sedláková*

## **Abstract**

The financial market has a very important position in the area of finance, which, based on supply and demand, ensures the movement of money and capital between various economic entities. The financial markets also include the securities market. One of the main objectives of the securities market is to buy stocks cheaply at the right moment (buy undervalued stocks) and also to sell expensive stocks at the right time (sell overvalued stocks). The term "stock picking" refers to the selection of stocks and other instruments, which are referred to as undervalued and are therefore suitable for purchase. Undervalued stocks are typically traded at a low rate at some point due to their fundamental characteristics. In the future, undervalued stocks can be expected to rise in price, which can bring capital gains to an investor who bought at a low rate. Therefore, undervalued stocks are recommended for purchase. Timing of buying and selling signals, is an important prerequisite. The problem, however, is that no one knows exactly when the right moment will come, because the market price of stocks is influenced by many factors that have an impact on the volatility of the market value of the stocks. For this reason, modelling of volatility is at the forefront of the interests of many financial analysts and investors. The aim of the article is to analyse the behaviour of Komerční banka stocks within a given time interval - whether the stocks are affected by the new information or rather by the past values.

*Keywords: ARMA model, GARCH model, stocks, volatility, Komerční banka*

## **1 INTRODUCTION**

The so-called Mathematical modelling provides methods by which phenomena and activities that take place in a person's daily life can be studied. Thus, mathematical modelling makes it very easy to display complex questions or problems through mathematical equations or functions. One of the areas where mathematical models can be used very well is the area of finance, in which the financial market has a key position. Based on supply and demand, there is a movement of money and capital between different entities. The main platform for these financial transactions is stock exchanges, where the main attractions include stocks of large companies.

However, the problem with these transactions is a high degree of uncertainty, as stock volatility is largely unpredictable. Reasons include, for example, measures or regulations of governments in a given country, market expectations, financial or other crises, or the political situation in a given country. For this reason, prediction or modelling of stock volatility comes to the forefront of the interests of many investors, economists, speculators or financial analysts.

The aim of this article is to analyse the behaviour of Komerční banka stocks within a given time interval. This behavioural analysis will be performed based on the residue distribution calculated from the GARCH model, which will be estimated from the data. The work will analyse both the expected changes that follow the normal distribution, but mainly unexpected changes - the so-called heavy tails.

The article uses as a data source the time series of Komerční banka stocks in the period from January 2018 to February 2019. For the analysis itself, the statistical software R was used as a tool.

## 2 THEORETICAL BACKGROUND

### Time series issues

The time series represents the so-called numerical variable, the values of which are largely dependent on the time in which these values were obtained. It is basically a sequence of chronologically arranged observations. The time points at which the data were obtained are usually equally distant from each other (Enrique et al., 2020; Litschmannová, 2010).

Description through descriptive statistics can provide a sufficient idea of the properties of a time series as a single data unit but does not provide information about its time evolution (Litschmannová, 2010; Müller, & Watson, 2019).

Time series can be classified on the basis of various aspects (Litschmannová, 2010): (a) according to the nature of the data, the values of which form a time series, (b) interval time series - the data depends on the length of the interval that is monitored, (c) instantaneous time series - data refer to a specific moment, (d) according to the periodicity with which the data are monitored, (e) time series of annual data, (f) short-term time series, (g) by type of data monitored, (h) time series of absolute indicators, (i) time series of derived characteristics - e.g. cumulative time series.

Time series are the result of observations made at discrete time points. Some of them are then discreet in their nature (as an example, time series of total production of a certain agricultural crop for individual years), others need to be "discretized" first. Thus, time series can be created by discretization of values of a continuously changing quantity (e.g. a series of values of amplitude of a signal at given time points), accumulation of values of monitored quantity for a given time period (daily precipitation totals in meteorology) or by averaging values of considered quantity in given time interval. (average daily temperatures) (Křivý, 2012).

If there is a choice, then it is recommended to choose a compromise solution. The high density of observation time points allows the characteristics of the time series to be well captured, but calculation difficulties can occur. The choice of equidistant intervals between adjacent observations should be a matter of course. As part of the analysis of economic time series, problems associated with the calendar may occur (different lengths of calendar months, different number of working days per month, moving holidays). In such cases, a so-called "standard month" of 30 days or a standard number of working days per month is usually introduced, or the observed data are accumulated. The length of a time series is defined as the total number of observations in the time series, not as the time span between the first and last observations (Gorgi, Koopman, & Li, 2019; Hunter, Burke, & Canepa, 2017; Křivý, 2012).

### Time series autocorrelation

A key assumption underlying the linear regression model (LRM) commonly used in applied econometric studies is a sufficient limitation of a phenomenon called autocorrelation (Killick et al., 2020; McGuirk, & Spanos, 2002).

An important feature of time series is their (potential) serial correlation. Therefore, a thorough analysis and visualization of these correlations is needed. The autocorrelation between two random variables  $X_t$  and  $X_{t+k}$  can be described as follows (Dettling, 2018).

$$Cor(X_{t+k}, X_t) = \frac{Cov(X_{t+k}, X_t)}{\sqrt{Var(X_{t+k})Var(X_t)}} \quad (1)$$

Since moments are required for stationary data to be constant over time, autocorrelation can be written for these values as a function of delay (Dettling, 2018):

$$\rho(k) = Cor(X_{t+k}, X_t) \quad (2)$$

The most common autocorrelation test in the regression model is the borderline Durbin - Watson test, which is used to test the independence of residues in the normal regression model. The test finds application when the data are obtained sequentially, and the values of the dependent variable form a time series (Dufour, & Dagenais, 1984; Lee, 2016).

Durbin - Watson test is calculated as (Dettling, 2018):

$$\tilde{D} = \frac{\sum_{t=2}^n (r_t - r_{t-1})^2}{\sum_{t=1}^n r_t^2} \quad (3)$$

### Model AR-1

The autoregressive model of a time series is based on the assumption that any value in a time series depends on the previous value of that series. The autoregressive model AR (p) of order p can be defined as follows (Danel, 2004):

$$y_t = b_1 y_{t-1} + b_2 y_{t-2} + \dots + b_p y_{t-p} + \epsilon_t \quad (4)$$

Where  $b_1, b_2, \dots, b_p$  are the coefficients within the autoregressive process,  
 $\epsilon_t$  so-called white noise (current value),  
 $y_t$  new series value calculated based on previous values.

### MA moving sum model

The process MA (q) – (Moving Average) - of order q can be written as follows (Danel, 2004):

$$y_t = \epsilon_t + w_1 \epsilon_{t-1} + w_2 \epsilon_{t-2} + \dots + w_q \epsilon_{t-q} \quad (5)$$

Where  $w$  are the parameters of the model,  
 $\epsilon_t$  is white noise.

### ARMA model

By combining the already mentioned processes AR (p) and MA (q), a mixed process in the form of ARMA (p, q) can be obtained (Danel, 2004; Zaw, Kyaw, & Oo, 2020).

The condition of stationarity of the ARMA process coincides with the condition of stationarity of the AR process (p) and the condition of process invertibility is the same as the condition of process invertibility MA (q). The mean value of the ARMA process is also zero (as in the previous AR and MA processes) and its autocorrelation function satisfies a similar system of difference equations as in the AR process. Several alternative options can be selected for writing the ARMA process in the form of a difference equation, a linear process or in an invertible form. For each AR model of order p, an equivalent MA model with a sufficient number q of the interference element can be found. Economic or business time series can be modelled using a relatively small number of p and q elements within the AR, MA or ARMA model. The aim is to find or determine the smallest number of p and q elements needed for satisfactory time series prediction (Danel, 2004; Chen, Chang, & Cheng, 2019).

### 3 METHODOLOGY

First of all, the source data must be treated so that there is no non-stationarity and inhomogeneity in the data. The so-called autocorrelation also occurs as an undesirable phenomenon in the case of time series. Failure to respect the autocorrelation of residues results in skewed estimates of unknown parameters, which also affects other characteristics. If autocorrelation occurs in the time series, then the residues are not independent. The time series therefore need to be cleaned so that the resulting p-values are not skewed. Therefore, time series will be logarithmized first, which will remove their multiplicative character (multiplicative changes of time series will be converted to additive changes). Then the method of the so-called 1st order difference (differentiation of source data) will be applied, which will remove the non-stationarity of this data. To verify that the given values are independent, the so-called autocorrelation function (independence verification) and partial autocorrelation function (independence verification when removing the influence of the third quantity) will be used. The autocorrelation function (ACF) is a suitable imaging tool for detecting visible patterns in data. The ACF value then indicates at different time intervals (Lag) whether there is any form of automatic correlation in the data.

Next, the GARCH model (with parameters  $p, q$ ) will be used, which is a model for examining time series volatility. Using the GARCH model, heteroskedasticity will be removed from the data. At this point, the already adjusted data show the characteristics of white noise, which means that all influences are removed - so we obtain independent, equally distributed (same variance) of the random variable. In addition to the above assumptions (homogeneous, stationary series and non-correlation of logarithmic returns), the third assumption of volatility models, which is the normality of logarithmic returns, must be observed. Histogram display can be used to verify the normality of residues.

### 4 RESULTS

The models will be applied to the time series of Komerční banka stocks. This is a series with a length of 285 observations. This is the daily development of stocks, with the exception of weekends and holidays, from January 2018 to February 2019. The development of stocks in this period is shown in Figure 1.



Fig. 1 – Daily development of Komerční banka stocks. Source: own research

At first glance, it is clear, that the series is inhomogeneous and non-stationary. For verification, the so-called autocorrelation function is used by default, which can be seen in Figure 4, and the

partial autocorrelation function shown in Figure 5. The time series must be inserted into the software R. A preview of this data is shown in Figure 2 (the word "akcie" means stock). commands for autocorrelation (verification of stationarity) and partial autocorrelation function (verification of the influence of the third quantity) shown in Figure 3.

```
> akcie <- read.table(file = "C:/Users/Marketka/Desktop/data.txt")
> akcie
      V1
1  925.0
2  930.0
3  935.0
4  945.0
5  934.0
6  925.0
7  924.0
8  924.5
9  925.0
10 934.5
11 933.0
12 931.0
13 930.0
14 929.5
15 930.0
```

Fig. 2 – Snippet of data entered into software R. Source: own research

```
> acfRes <- acf(akcie)
> pacfRes <- pacf(akcie)
```

Fig. 3 – Commands for autocorrelation and partial autocorrelation function. Source: own research

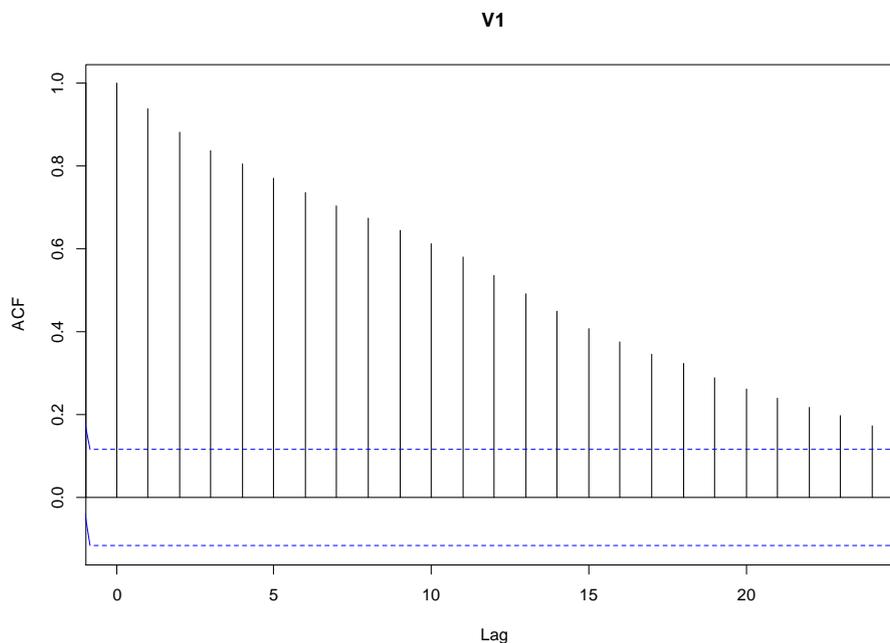


Fig. 4 – Autocorrelation function (ACF) of Komerční banka stocks. Source: own research

The autocorrelation function (ACF) is a suitable imaging tool for detecting visible patterns in data. The ACF value at different time intervals (Lag) indicates whether there is any form of automatic correlation in the data. In the Figure above, you can see clearly visible patterns between the data. In other words, a clear violation of the presumption of independence can be noticed.

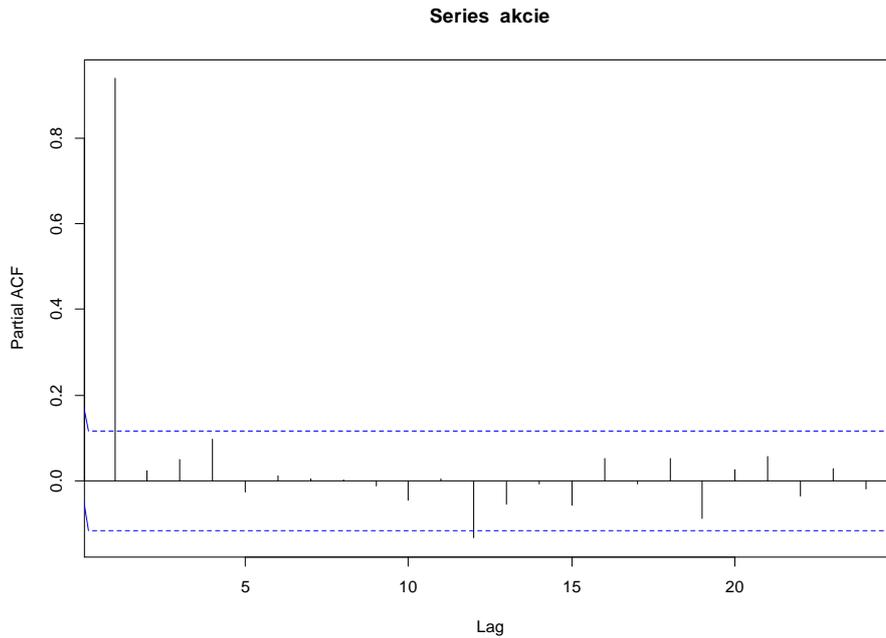


Fig. 5 – Partial autocorrelation function (PACF) of Komerční banka stocks. Source: own research

The autocorrelation function gradually decreases and the first PACF value is close to 1, which indicates that the series is not stationary.

In order to apply the models, a number of KB stocks need to be transformed. Thus, it will be necessary to logarithm the data, which will remove their inhomogeneity, and subsequently it will be necessary to make a difference, which will remove their non-stationarity.

An image of the logarithmic data is shown in Figure 6 and an image of the subsequent difference in Figure 7.

```
> akcie3=log(akcie)
> akcie3
      V1
1  6.829794
2  6.835185
3  6.840547
4  6.851185
5  6.839476
6  6.829794
7  6.828712
8  6.829253
9  6.829794
10 6.840012
```

Fig. 6 – Logarithmization of data. Source: own research

```
> akcie4=diff(akcie3$V1)
> akcie4
 [1]  0.0053908486  0.0053619431  0.0106383982 -0.0117084893
 [9]  0.0102178894 -0.0016064260 -0.0021459236 -0.0010746911
[17] -0.0043715917  0.0049166993  0.0092216547  0.0096722946
[25]  0.0088790816  0.0326115856 -0.0102123973 -0.0070480097
[33] -0.0010649628 -0.0090982699 -0.0032310206  0.0021551732
[41] -0.0027019741 -0.0065146810  0.0021762794  0.0048793808
[49]  0.0053966672 -0.0070213629 -0.0043454713  0.0124426815
[57] -0.0129172948  0.0054024983  0.0021528534  0.0085653629
[65]  0.0073031102  0.0031136507  0.0000000000 -0.0036335363
[73]  0.0021586625 -0.0048635600 -0.0016264574 -0.0016291071
```

Fig. 7 – Making a difference of data. Source: own research

It is now possible to identify the model by estimating the autocorrelation and partial autocorrelation functions, which are shown in Figures 8 and 9. It can be deduced that this is indeed a stationary series, because ACF values no longer gradually decrease but move in a certain interval.

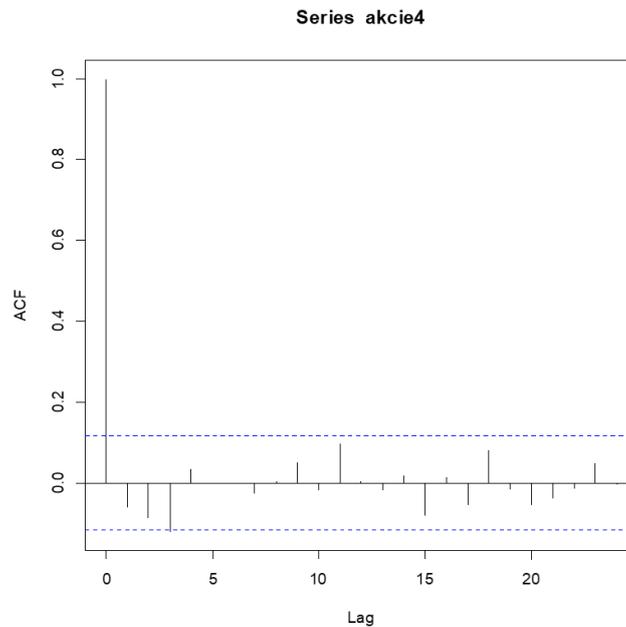


Fig. 8 – ACF stationary series of Komerční banka stocks. Source: own research

The dashed line in the correlogram determines the truncation points (confidence interval). Values between zero and this limit are considered insignificant, ie zero. Thus, it is clear, that the series does not contain any MA process because the ACF values are zero.

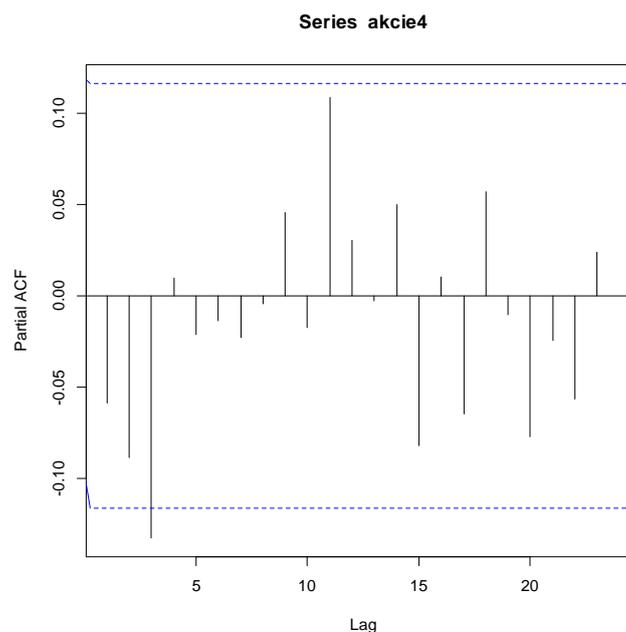


Fig. 9 – PACF stationary series of Komerční banka stocks. Source: own research

The partial autocorrelation function helps determine the order of the AR process. However, the monitored series also does not include this process, because all PACF values are insignificant. Correlations could not be demonstrated in this time series, so the whole series is considered white noise. The GARCH model will therefore be used for modelling.

### Estimation of volatility models on the time series of Komerční banka stocks

Now the volatility model will be applied to the same time series of KB stocks. The GARCH model (p, q) will be used. However, before the GARCH model is applied, the basic assumptions for modelling the volatility of a given series must be verified. A significance level of 0.05 is considered for all tests below.

The given time series must again be transformed into a stationary series by means of logarithmization and subsequently difference. Figures 8 and 9 are proof of the stationary series. Furthermore, the non-correlation of logarithmic returns is determined, for example using the ACF and PACF functions. As already shown above, the given time series does not contain a correlation of random variables.

The third basic assumption of volatility models is the normality of logarithmic returns. The Jarque - Ber test can be used to verify normality. For JB test, the null hypothesis is followed, for which the normality of the distribution of logarithmic returns is assumed, as well as the alternative hypothesis, which states that logarithmic returns do not have a normal distribution. The p-value is very low ( $2.2e-16$  - Figure 11), which is less than the significance level of 0.05, so the normality of logarithmic returns must be rejected.

A histogram was also used as confirmation. The fact that the logarithmic yields do not have a normal distribution is shown in Figure 10, which shows a histogram of the actual distribution of the logarithms of the series yields. Logarithmic returns have a sharper distribution, which is typical for financial series.

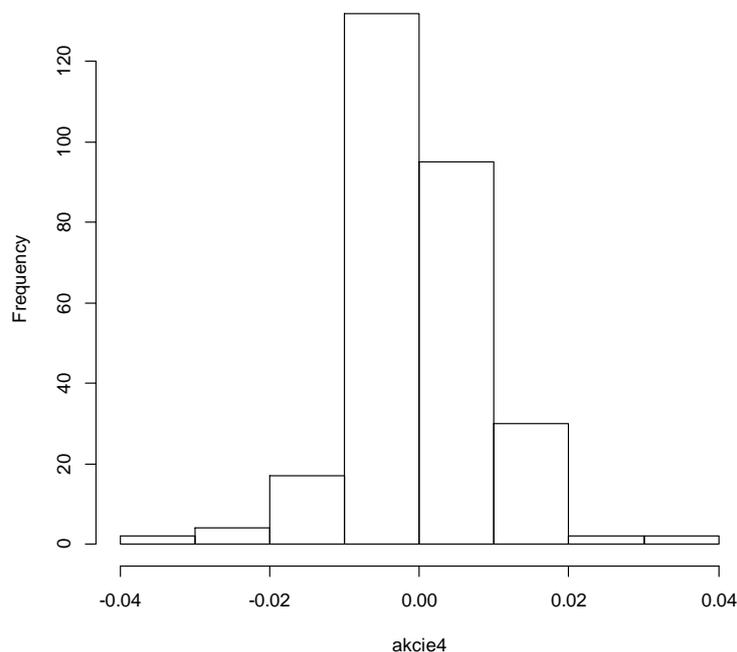


Fig. 10 – Histogram. Source: own research

Although the Jarque-Ber test did not show the existence of a normal distribution in the data, this time series can be used in the volatility model. The GARCH (1,1) model will be applied to the time series, which is the most used model for examining time series volatility. The results from the R studio are shown below in Figure 11.

```

> summary(arch.y)

Call:
garch(x = y, order = c(1, 1))

Model:
GARCH(1,1)

Residuals:
    Min       1Q   Median       3Q      Max
-4.2741 -0.5311 -0.0111  0.5278  4.6664

Coefficient(s):
      Estimate Std. Error t value Pr(>|t|)
a0 3.564e-05   2.527e-05   1.411   0.158
a1 9.140e-02   6.998e-02   1.306   0.192
b1 4.876e-01   3.488e-01   1.398   0.162

Diagnostic Tests:
      Jarque Bera Test

data: Residuals
X-squared = 118.47, df = 2, p-value < 2.2e-16

      Box-Ljung test

data: Squared.Residuals
X-squared = 0.47471, df = 1, p-value = 0.4908

```

Fig. 11 – GARCH function (1,1). Source: own research

A more important parameter in the model is the parameter b1, so the resulting model GARCH (1,1) has the form:

$$\rho_t^2 = 0,00003564 + 0,0914e_{t-1}^2 + 0,487\rho_{t-1}^2 \quad (6)$$

However, the Pr value is greater than the significance level of 0.05. For this reason, it is white noise. It can therefore be stated that the market values of Komerční banka stocks in the period under review are not affected by the impact of new information but are also not affected by past variance values. However, if this were not the case, based on the parameters of this function, it can be stated that the impact of new information ( $e_{t-1}^2$ ) is not as important within this time series as past values of variance ( $0,4876\rho_{t-1}^2$ ) and the modeling of market values of stocks should be based on past values, as this is the most significant factor influencing this time series.

The GARCH (0,1) model can also be applied to the time series, which is also a frequently used model in the study of time series volatility. The results from the R studio are shown in Figure 12.

```

> summary(arch.y)

Call:
garch(x = y, order = c(0, 1))

Model:
GARCH(0,1)

Residuals:
    Min       1Q   Median       3Q      Max
-4.02586 -0.52718 -0.01033  0.52449  4.37558

Coefficient(s):
      Estimate Std. Error t value Pr(>|t|)
a0 8.248e-05   5.314e-06  15.522 <2e-16 ***
a1 2.118e-02   6.142e-02   0.345   0.73
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Diagnostic Tests:
    Jarque Bera Test

data:  Residuals
X-squared = 89.696, df = 2, p-value < 2.2e-16

    Box-Ljung test

data:  Squared.Residuals
X-squared = 0.026868, df = 1, p-value = 0.8698

```

Fig. 12 – GARCH function (0,1). Source: own research

A more important parameter in the model is the parameter  $a_1$ , the resulting model GARCH (0,1) has the form:

$$\rho_t^2 = 0,00008,248 + 0,02118e_{t-1}^2 \quad (7)$$

The value of the indicator Pr is less than the significance level 0.05 only in the case of parameter  $a_0$ . Therefore, it can be stated again that the impact of the new information is not significant in the model, therefore it is a white noise and the market values of Komerční banka stocks in the monitored period are not affected by the new information.

## 5 DISCUSSION

The aim of the article was to apply the ARMA and GARCH model to the time series of Komerční banka stocks using the analysis in the R software and to find out the behaviour of these stocks. The most commonly used form of autocorrelation is first-order AR (1) autoregression, which was also used.

Based on the GARCH (1,1) and GARCH (0,1) models, it was found that the examined time series of market values of Komerční banka stocks showed signs of white noise. The market values of Komerční banka stocks in the period under review are therefore not affected by the impact of new information but are also not affected by past variance values.

This means that when forecasting the market values of Komerční banka stocks, the investor does not have to take into account their past development or the impact of new information.

The issue of time series of stocks is a very specific topic, because what may apply in one market may not apply in another market, or even what applies to the market values of stocks of one

company may not show the same results for another company. The resulting values are also affected by the observed period, when in a certain period the results may be completely different from other periods.

If the time series of market values of Komerční banka stocks did not show white noise values, it could be said that the impact of new information is not as important within the examined time series as past values of variance and stock value modelling should be based on past values, as it is the most important factor influencing the market value of stocks.

## 6 CONCLUSION

The issue of time series of stocks is a very specific topic, because what may apply in one market may not apply in another market, or even what applies to the market values of stocks of one company may not show the same results for another company.

The resulting values are also affected by the observed period, when in a certain period the results may be completely different from other periods. If the time series of market values of Komerční banka stocks did not show white noise values, it could be said that the impact of new information is not as important within the examined time series as past values of variance and stock value modelling should be based on past values, as it is the most important factor influencing the market value of stocks.

However, it would be useful to extend this research to other markets, to other periods and to other companies. Only with this thorough analysis can the behaviour of stock market values be clearly determined. This is the issue I will address in my dissertation. For the needs of this dissertation, data will be obtained in the form of the market value of stocks in the markets of Europe, China and the USA in the form of economic time series. The stocks of 10 companies in each market will be analysed, so a total of time series of market values of the shares of 30 companies will be needed. The output of the dissertation will be a comparison of the behaviour of corporate stocks in different markets. Furthermore, answering the questions of whether stocks in different markets receive the same shocks or not, or whether shocks occur more often in a market. Also the output will be graphical information on the differences of different distributions, and therefore it will be possible to easily interpret the results from an economic point of view.

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# TRIZ TOOLS FOR MANUFACTURING PROCESSES IMPROVEMENT

*Vladimír Sojka, Petr Lepšík*

## **Abstract**

Manufacturing companies are pushed to the continuous improvement of their processes for establishing their competitiveness and their position in the fast-evolving market. For these purposes, methodologies as Lean or Six Sigma are often used. These nowadays tools could not provide ideal solutions for identified problems. The quality of new ideas for improvement depends on the experiences of the solving team members, and final results are often affected by psychological inertia. Found solutions are often not the best possible solutions in terms of technical system evolution, or there can appear secondary problems from the solution of the primal problem. The solution for this could be the use of systematic creativity tools as TRIZ (Theory of Inventive Problem Solving). Tools of systematic creativity should provide better and more innovative solutions for problems without any trade-offs or secondary problems. This paper shortly summarizes the current state in a field of TRIZ tools integration with tools and methods used for manufacturing processes improvement, and it shows other possible approaches on how to use the TRIZ tools for more effective and more innovative improvement of manufacturing processes. That can be the development of a new standalone method for process improvement, based on TRIZ tools, methods, and ideologies.

*Keywords: TRIZ, process improvement, continuous improvement, process innovation*

## **1 INTRODUCTION**

In a field of manufacturing processes, there are efforts to improve parameters of the process as production time, costs, and quality. It is good to also consider safety, ergonomics, and ecology of processes. Manufacturing processes can be improved by many tools or methods. Very spread are methods as Lean or Six Sigma. The lean methodology is focused on value – activities in a process which generates value for the customer, and elimination of wastes – all activities, which are not adding value. The Six Sigma methodology aiming at the quality of a process, the number of defects which are reduced to a minimum by reduction of variability of process outcomes. With common tools from methodologies like Lean or Six Sigma not the best possible solutions for problems could be found. In some cases, the non-ideal solution to problems can lead to secondary problems. (Mašín & Jirman, 2012)

With the help of a systematic creativity approach, we can achieve much better results in searching for solutions to found problems. One of the methods from systematic creativity is TRIZ (Theory of Inventive Problem Solving). TRIZ is based on the research of thousands of patents. Repeating patterns of problems and their solutions were found. On the base of these findings, a set of tools and methods was developed for a systematic way how to solve those problems in a way of technical system evolution. (Mašín & Jirman, 2012)

This paper aims at a review of the current state of integration of TRIZ tools and methodologies with other tools for process improvement. Paper also deals with propose for the next use of TRIZ tools for process improvement in practice.

## 2 THEORETICAL BACKGROUND

TRIZ is an acronym from Russian теория решения изобретательских задач, in English the Theory of Inventive Problem Solving (also known as TIPS). It is a philosophy based on the research of thousands of patents. There were found patterns that are repeating in time. In history, there were repetitively appearing the same types of problems, regardless of the type of the technical system. These repeating problems were solved by a limited number of types of solutions. Based on these findings, TRIZ tools were designed. These tools help with solutions to very challenging problems in a way, that the solution is not influenced by a vector of psychological inertia. Solutions are directing in a way of imaginary ideal solution which is in the direction of the evolution of the technical system. (Jirman & Logvinov, 2015; Mašín & Jirman, 2012)

TRIZ is mostly used for the innovation of products, but its core is to solve problems in general. That is why tools and methods from TRIZ can be used in any field, not only for product development. TRIZ itself or with other tools was used by many authors for improvement of product or processes in different fields for example winery (Quartly-Watson, 1999), art (Duepen, 2004), software (Stanbrook, 2002), and others.

## 3 METHODOLOGY

Because TRIZ should be a universal method for solving any problem it calls for use for problem-solving in manufacturing process improvement. First, literature research on the current state of the use of TRIZ for improvement of processes was done. From the results of the literature research suggestions for the next development of the TRIZ method for process improvement were set.

### Literature research on TRIZ for process improvement

As it is shown before, TRIZ can bring innovative solutions for problems in companies. Many authors before, tried to integrate TRIZ tools with other common tools from Lean, Six Sigma, and other methodologies. A brief summary of the current state in the integration of TRIZ with other tools follows.

Use of TRIZ for process improvement is discussed for example in (Livotov et al., 2019) authors linking TRIZ and process intensification. Another use of TRIZ for process improvement is in (Su & Su, 2018), where the manufacturing of colour filters is improved by TRIZ. Swee et al. (2017) discuss the use of TRIZ for improvement of the production quality, and Li et al. (2017) give us an approach for innovation of technological processes and production by TRIZ. Many authors come with the result, that TRIZ tools should be used as tools for Lean. Ikovenko and Bradley (2004) and Bligh (2006) found a use for TRIZ tools in case of waste elimination or for improvement of other techniques as Value stream mapping, 5S, Kanban, and others. Similarities between Lean and TRIZ are shown in tables Tab 1. and Tab 2.

Tab. 1 – Similarities between Lean wastes and TRIZ function categories. Source: own research

Wastes from Lean	Representation by TRIZ functions
Overproduction	Excessive Functions
Inventory	Corrective Functions
Overprocessing	Providing and Corrective Functions
Movement	Providing and Corrective Functions
Defects	Insufficient, Excessive or Harmful Functions
Waiting	Insufficient Functions
Transport	Providing Functions

Waste could be also eliminated in a way, that from non-value adding activities technical or physical contradictions are made. These contradictions can be solved by the use of inventive principles, separation principles, and other TRIZ tools (Thurnes, Zeihsel & Hallfell, 2014). Ikovenko and Bradley (2004) show that for solving Lean problems, the TRIZ can be used with potentially better results. Another example of Lean/TRIZ integration could be the use of TRIZ tools for problems for its solving Lean toolset is not enough (Bligh, 2006). TRIZ techniques can be also used for future state design. For this purpose, use of the theory of technical system evolution with S-Curves theory are beneficial (Ikovenko & Bradley, 2004; Navas & Machado, 2015). By a knowledge of the direction of technical system evolution, there is easier to predict how the new state of the system should look alike. Thurnes (2014) edit and expand the list of inventive principles for easier use in Lean projects. For resolving of Lean problems, the glossary with edited principles can be used. The use of a Lean/TRIZ combination for eco-efficient solutions is reviewed by Alves et al. (2020).

Tab. 2 – Lean techniques and TRIZ tools which can be used. Source: own research

Lean techniques	TRIZ tools
Value Stream Mapping – current state	Function model
Value Stream Mapping – future state	Trimming, Cause-effect Chain analysis
Kanban	Inventive principles, Standards, Trimming
Standardized work	Inventive principles, Standards
Balancing of work	Function model
5S	Transition to the supersystem, Trimming, Standards

Other authors tried to integrate TRIZ with Six Sigma method. Averboukh (2003) claims that by integrating TRIZ with Six Sigma, the Six Sigma method would be considerably better. By the use of TRIZ, the occurrence of weak points in Six Sigma projects is avoided. A toolset of TRIZ is used in steps of DMAIC (Define, Measure, Analyse, Improve, Control) cycle by several authors (Zhao, 2005; Xie & Li, 2009; Kermani, 2003; Soti, Shankar, & Kaushal, 2012). These authors also describe which TRIZ tools could be used for each step of the DMAIC cycle, as it is seen in figure Fig. 1.

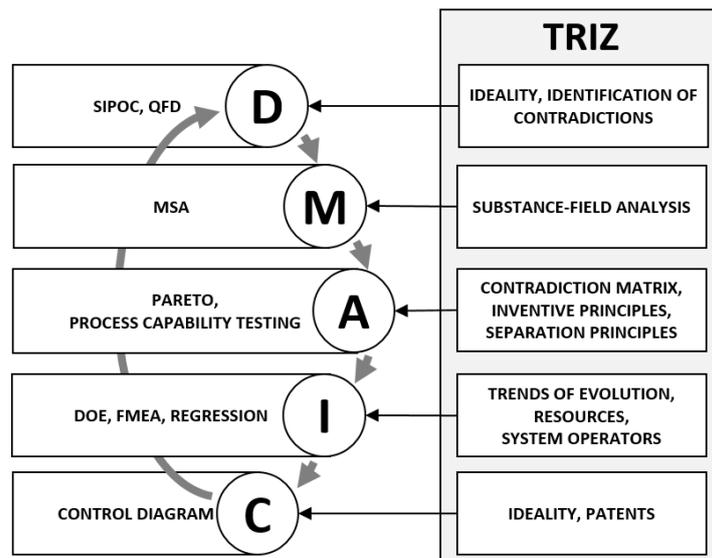


Fig. 1 – Use of TRIZ tools in steps of DMAIC cycle.

Source: Zhao (2005), Xie & Li (2009), Kermani (2003), Soti, Shankar, & Kaushal (2012)

Averboukh (2006) discusses an important problem for TRIZ use. The problem is the difficult training of new TRIZ users. TRIZ is not an easy method and its use by inexperienced users is not easy. The success of all integrations of TRIZ with other tools depends on good and easy

training. In other words, if we want to use TRIZ or its tools, good training is crucial. Brad (2010) described a complex algorithm, which integrates TRIZ with Six Sigma in 12 main steps. There is the identification of goals, reformulation of problems, and choice of vectors of a solution by vectors of inventive principles. Special software is needed for the use of this algorithm. The algorithm itself is very complex, complicated, and quite difficult for use, as the author himself confirms.

The integration of TRIZ with Lean-Six Sigma is similar to the integration with Six Sigma (Wang & Chen, 2010; Jiang & Nguyen, 2015). Noteworthy is an idea of the use of TRIZ for innovation of the system after its previous optimization (Barkan, 2011). This suggestion is only theoretical, without more specific guidance on how to do it in practice. Without previous experiences with TRIZ, it is very hard to implement it.

Many papers describe the use of TRIZ for the improvement of the QFD (Quality Function Deployment) method. There are efforts to achieve better efficiency of QFD. By Domb (1997) and Hu and Yeh (2011) TRIZ can be used for resolving problems found by QFD. TRIZ in connection with TOC (Theory of Constraints) by Mann and Stratton (2000) and Li et al. (2006) could be used for resolving problems defined by Evaporating Cloud. Conflicts from Evaporating Cloud can be eliminated by tools for the elimination of contradictions. TRIZ could be also used for better idea generation in methods based on Brainstorming. It can be an improvement of Brainstorming itself (Campbell, 2003), or other similar methods, for example, 6 thinking hats (Mann, 2001).

Suitability and potential of TRIZ use together with other tools are proved by the number of methods, tools, and techniques which were tried to be improved or integrated by TRIZ. Other tools which authors attempted to integrate with TRIZ are for example: SMED (Single Minute Exchange of Dies) (Kumaresan & Saman, 2011), Mind Maps (Care & Mann, 2001), FMEA (Wang et al., 2005), 8D report (Navas & Machado, 2015), NLP (Neuro-Linguistic Programming) / Neurosemantic (Bridoux & Mann, 2002), use of TRIZ for non-technical problems and many others.

## **4 RESULTS**

Results of literature research are that the connection of TRIZ with other tools is in general considered as good. Suitability of the connection is supported by a high number of tools that were used for connection with TRIZ in many articles. The main obstacle is the complexity of TRIZ. Learning or training for new users is very challenging and for an appropriate level of TRIZ knowledge, the learning can take a lot of time. That is why is the use of TRIZ with other tools for process improvement in practice very hard.

Next problem is that found solutions from literature research are in most cases either abstract or too complex for easy use. In other cases, the use requires special software which is often difficult to access. In many publications, there is only a statement, that a combination of TRIZ with some tool should have positive results. In other cases, there is no clear guide on how to go step by step through general problems. That all decrease the probability for practical use of TRIZ tools integrated with common tools for improvement of processes. These obstacles show on difficulties for transmission from spheres, where the TRIZ is already well known, to other spheres of use. If the user is without knowledge and experience of TRIZ, effective use of TRIZ for process improvement is almost impossible.

The consequential result could be to leave attempts to integrate TRIZ with other tools. And instead of that design a new standalone tool based on TRIZ principles. A method or an algorithm with the main purpose of process innovative improvement. One of the biggest

obstacles is to design this new method in a way for easy use in practice. The final method must be after training quite easily applicable in real processes for instance by Industrial Engineers in manufacturing companies.

## 5 DISCUSSION

From the research, there is clear that TRIZ can be used with positive results in different areas. Process improvement could be the next beneficial area of TRIZ use. The only problem is the difficulty of TRIZ use for common applications in practice. A standalone method or tool based on TRIZ principles should be designed. The Lean methods are focusing on Value and waste, Six Sigma is focused on Defects and variability of the process. New Method could be focused on the Ideality level of the process. The concept of Ideality is one of TRIZ's crucial principles, and it can be described by equation (1).

$$I = \frac{\sum B}{\sum H + \sum C} \quad (1)$$

Where  $I$  is the *Ideality* of the System,  $B$  is *Benefits* or positive functions of the system,  $H$  are *harms* or negative functions of the system, and  $C$  is *Costs*. If we would be able to determine benefits or positive functions and harms or negative functions of the process, we would be able to calculate an Ideality level of the process. The Ideality could be calculated before and Improvement of the process should increase the Ideality level.

An Ideal Final Result (IFR) is one of the TRIZ tools based on Ideality principle. It leads us to search for a solution in a way of the ideal result. The ideal state of the Process could be express as the state when products are made itself, without any effort or costs, while there is no process. We obviously cannot reach the ideal state but we can try to be closer. In practice, it could mean an effort to reduce the number of steps in the process for faster and cheaper production with fewer defects. And achieve this state without big investing. By increasing of Ideality level a better state of the process should be achieved. Different TRIZ tools could be used for generating innovative solutions to find problems. Innovative solutions could push the manufacturing process on a higher more innovative level.

### 5.1 Draft of the method

Requirements on the new method resulting from literature research. Main factors are increasing of process Ideality level and usability in practice. After an initial analysis of the current state and calculation of Ideality level, several TRIZ tools should be used. Tools which should be considered for use in method are (a) IFR (Ideal Final Result), (b) Operator STC (Size, Time, Cost), (c) List of resources, (d) Function modelling, (e) Trimming, (f) Contradiction modelling, (g) Invention principles, (h) Separation principles, and other TRIZ tools and methods.

All tools must be probably modified for the more effective and more easy application on manufacturing processes. The use of these tools could lead to process innovation in a way of technical system evolution, and it should avoid bad solutions occurrence influenced by psychological inertia.

## 6 CONCLUSION

The current state of efforts in the integration of TRIZ with other tools shows the advantages of TRIZ use beyond the limits of classical use. Authors agree on the beneficial use of TRIZ in different fields. In a field of process improvement, there are many publications dealing with the integration of TRIZ with other well-known tools. Not all publications give us a clear guide on

how to proceed in the improvement of a common process. One of the biggest obstacles for TRIZ use in industrial practice is the difficulty and complexity of TRIZ itself. It is clear, that good training is necessary before TRIZ will be used in process improvement.

An appropriate solution could be a design of a new standalone method for process improvement based on principles and tools of TRIZ. The core algorithm of the method should be based on the concept of the Ideality of the Technical System. The final design of this method should take into consideration the simplicity of use by engineers in industrial practice.

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# INFLUENCER MARKETING TAXONOMY FROM A BRAND POINT OF VIEW

*Monika Stanková, Martin Kuchta*

## **Abstract**

Influencers have ability to significantly affect their followers and change their shopping decision making process. Companies can utilize influencers as distribution channel for marketing messages which are intended for defined target groups. Thus, influencers became an inherent part of the marketing communication strategies of companies and created new marketing approach called influencer marketing. To make the influencer marketing effective and to reach desired communication effects it is necessary to know influencer marketing possibilities and to properly set whole process from the beginning. The main aim of the article is to identify and accurately describe the influencer marketing possibilities as an effective tool for marketing communication of brands. Observation was utilized as the main research method and the authors analysed five hundred influencer social media profiles. Every new observation was noted into Excel table and subsequently there was a summary scheme created. Developed taxonomy has elements of process map and contains six steps, which focus on categories for an influencer marketing activity, approaching an influencer, types of cooperation, placements of communication, types of target group reach, and rewards for an influencer. Created taxonomy can serve as a guide for companies to create an effective influencer marketing strategy and to reach brand targets.

*Keywords: brand promotion, digital marketing, influencer marketing, social media, taxonomy*

## **1 INTRODUCTION**

Development of the internet, rapid extension of information technologies, which allow internet consumption, and high penetration of the internet developed many new marketing segments, which did not exist few years ago, however brands actively utilize them within digital marketing strategies nowadays. One of the segments is influencer marketing, which has recently cut significant amount of marketing investments dedicated to more standard digital marketing segments. Nowadays when the popularity of social media is growing relentlessly, it is almost a duty of any form of business to acquire the know-how associated with this new phenomenon and secure its place in the traditional and digital market.

Influencer marketing is undoubtedly the most widely used type of marketing strategy today, especially because it allows companies to reach target groups in a unique way. It is a form of marketing in which the emphasis is on specific individuals rather than on the target market as a whole. Influencer marketing identifies individuals who have an impact on potential buyers, and all the marketing activities are oriented around the so-called influencers. Influencers are trusted by most of their followers to the point that they can influence their general opinions as well as shopping behaviour with their recommendations. Social media has become an increasingly important part of our lives, and so are the factors that can affect us as consumers. The typical user of Internet platforms consumes a large amount of content from posts that affect him. And that's why influencer marketing has become so popular and successful.

## **2 LITERATURE REVIEW**

### **Who is an influencer?**

Influencer can be perceived as a new type of independent media, which influence attitude of audiences through articles and posts on social media (Freberg, Graham, McGaughey, & Freberg, 2011). Influencer can be a well-known person, an athlete for instance, who created social media profile where he regularly shares information about his carrier and personal private life. Studies show that utilization of athlete influencer within a digital marketing strategy is directly connected to increase sales of products promoted as well as the values of a company. Increase in value of a company has tendency to be constant, however increase in sales has a decreasing trend in time (Elberse & Verleun, 2012). The fact can be caused by satiety of an influencer by brands and by never-ending propagation of products.

### **Who are followers?**

People follow influencers on social media especially because of the interests of influencer, which correspond with interests of a follower, trustworthiness and authenticity (Coco & Eckert, 2020). Followers interact with posts of an influencer, write comments, express an opinion on the posts created etc. Below the posts there is often a discussion, where followers also often discuss the products, which are illustrated in the post. From discussion it is just a small step to natively create eWOM and viral spread of the products or marketing campaign between users (Thoumrunroje, 2014). Due to researches people like to follow influencers, who publish positive pictures and provide enriching reviews of products (Djafarova & Rushworth, 2017).

### **Brand in the role of an advertiser**

Influencers have a capability to dispose with a significant number of followers, which they can reach through the social media. It represents opportunities for brands, which develop collaborations with influencers with a goal to utilize collected audiences for a product promotion. Influencers have an ability to create a better awareness about brand and to reach new audiences, which might be interesting in a brand as a new source of demand (Jilkova, 2018). Influencers are also able to help with development of follower base of a brand, which can be a key factor for trustworthiness of a brand, creation of a brand value, positioning of a brand, and for creation of a new communication channels with existing or potential customers (Potgieter & Naidoo, 2017).

The most recent studies show, that it is more effective to utilize an influencer instead of a celebrity within a marketing communication strategy for a brand (Trivedi & Sama, 2020). Utilization of an influencer is even more effective in case of communication of specialized products. Number of users who utilize social media to search information and purchase recommendations increase (Klačanská & Kohnová, 2018). Product promotion via influencer is more trustworthy, user shows higher sympathy to a brand, user feels stronger social dimension in promotion as well as a higher envy to an influencer with a product (Jin, Muqaddam, & Ryu, 2019). The last point rapidly increases probability of purchase of a product promoted. Integration of an influencer into a marketing communication of a brand on social media increases commercial value of a brand perceived by customers (Booth & Matic, 2011).

When using influencer marketing, it is crucial not to lose control over the brand and its commercial orientation, and also to be able to effectively use the celebrity dimension of influencer for the most effective intervention by promotion (Martínez-López, Anaya-Sánchez, Fernández Giordano, & Lopez-Lopez, 2020). The strength of the celebrity-dimension

influencer has been shown to improve the quality of the relationship between the recipient of the marketing message and the brand being promoted (Dwivedi, Johnson, & McDonald, 2016).

Influencer is a key choice for a brand to promote their product. Some influencers may have more marketing value than others. The marketing value does not necessarily have to depend only on the total number of followers. Influencers that track a few brands and other influencers act more credibly than influencers that track a larger number of other profiles (De Veirman, Cauberghe, & Hudders, 2017). For example, in electronic devices, it is more efficient to select a smaller influencer that specializes in given segment than an influencer that has more interference but extends to another segment.

Social networks generate a sufficient amount of data that, if correctly interpreted, can significantly help the brand in selecting the right influencer for the needs of marketing communication.

### **Sponsored post labels**

Studies suggest that sponsored post labels contribute to influencer credibility and have a positive effect on brand awareness (De Jans, Van de Sompel, De Veirman, & Hudders, 2020). Users still trust more their friends' recommendations than the influencers' recommendations (Cooley & Parks-Yancy, 2019), but influencers with a broad followers base can reach many more users, and such product promotion can also take on a viral character. This means that it will start spreading among people by itself without the need for additional investment in the distribution of promotion.

Users nowadays perceive influencers as friends. Due their unique, often personal and honest content users feel connection to an influencer and listen to their opinion. Thus, influencers have ability to modify users preferences and to direct them desired way. Influencers demand for monetization of their content meets companies desire for propagation of their brands and particular products what creates new effective media channel called influencer marketing. Since the channel is relatively new in a whole media mix it is often difficult for brands to know and identify all influencer marketing possibilities. Marketers often struggle with process of influencer marketing communication and rely on personal estimations. Influencer marketing is very unique discipline, which requires personal approach and it is very difficult to unify a process. However, look on already realized campaigns can offer summarization of possibilities of influencer marketing communication.

## **3 METHODOLOGY**

The main aim of the article is to identify and accurately describe the influencer marketing possibilities as an effective tool for marketing communication of brands. Result of the paper is influencer marketing taxonomy, which can serve as a source of information for brands, which are nowadays often overwhelmed by a large amount of confusing information, and also as a source of information for influencers themselves, who often do not reveal the full potential of their communication channels.

Observation was chosen as a main research method. The authors of the paper observed approximately five hundred social media profiles, which can be, due to number of followers exceeding one thousand, considered as influencers. Instagram was chosen as the social media for the observation. At the beginning of the research there was an excel sheet created where the authors noted all observed information. In rows the authors noted following information: (a) *Name or nickname* of an influencer. (b) *Instagram* website URL of an influencer. (c) *Country* of an influencer. (d) *Number of followers* of an influencer.

In columns author always noted a finding, which might participate on unification of influencer marketing process. The authors focused primary on following categories: (a) *Objectives* – during the observation type and form of commercial content on influencer profile often revealed marketing goal of a brand within an influencer marketing activity. (b) *Approach* – how an influencer was approached by a brand. Influencers often mention business partner in a comment of commercial content. (c) *Cooperation* – type of content an influencer created in order to fulfil business commitment. (d) *Placement* – form of content an influencer used in order to fulfil business commitment. (e) *Reach* – whether an influencer used only organic or also paid reach to gain desired results. The authors compared engagement of regular posts with engagement of commercial posts. If the engagement was significantly higher in commercial post the authors deduced that it was sponsored. (f) *Reward* – a way an influencer was rewarded for a cooperation. Influencer often write in a comment of commercial post whether it was a barter cooperation or they perceived some financial reward. In cases a commercial content didn't contain such an information the authors deduced the information.

Information within the categories were identified on base of observation and logical deduction of the authors. The observation lasted for a period of one week and the authors observed the posts with the oldest date of creation in January 2020. The obtained information made it possible to create a taxonomy that can also serve as a base for further theoretical and practical research in the field of influencer marketing. The findings presented in the research results are enriched by the knowledge of the authors gained during the experience developed by long-term cooperation with practice.

## 4 RESULTS AND DISCUSSION

### Influencer marketing taxonomy

Influencers are especially nowadays gaining in popularity, and their influence on the follower base represents an ideal opportunity for brands to get their products to potential customers. Due to the continually increasing number of influencers, brands often lose orientation in this segment and do not understand the possibilities that influencer marketing offers. The conducted research offers summarization of practices utilized within already executed influencer marketing campaigns. Information researched within observed categories described in the Methodology part of the paper were as followed:

**Category “objectives”:** (a) *brand awareness* - the product that appears natively in a photo or a video of influencer gets into the consciousness of the followers, thus creating awareness of the product and the brand as such, (b) *sales* - influencers may encourage followers to purchase the product they are promoting. It is often possible to incorporate a "call-to-action" element into posts and stories on social networks, which would eventually lead to sales. Another form can be various discounts that may increase sales, (c) *followers increase* - influencers may encourage their followers to start following the brand they are promoting. A reward for such following can be a package of products of the given brand. The brand thus gains followers on its social network, whom it can later monetize through its own marketing activities, (d) *brand building* - all influencers have their image. Some profile themselves ecologically, some focus on fashion, etc. Promoting product or brand with a particular influencer helps to build an image of the brand, which is gradually being taken over from the selected influencer.

**Category “approach”:** (a) *direct* - brand will contact influencer regarding a specific offer directly through its marketing department or a designated internal or external employee. All communication takes place in the brand's company, (b) *intermediary* - brand will contact an agency that deals with influencer marketing and has a sufficient know-how. The growth of influencers has created suitable conditions for the growth of such specialized agencies, which

serve as a mediator of communication between a brand and an influencer, (c) *digital platform* - a more sophisticated form of communication through an intermediary is to address an influencer through a specialized platform. An example is Lafluence.com. It is a platform to which brand logs in and creates marketing offers for cooperation. On the other side of the platform there are influencers who can also log in, and when they are interested in some of the brand's marketing activities, they can join it. A brand often writes precise requirements for objectives, locations, intervention, and promotion of such cooperation. It is also a type of a mediating cooperation, but in an automated form that requires only minimal, and in some cases zero, human input on the part of the mediator.

**Category “cooperation”:** (a) *product placement* - it is a product placement within post, story or video of a selected influencer. A product which is being promoted is usually displayed natively and its presence does not disturb the follower, (b) *review* - influencers receive the product from the brand and after some period of using it / testing it they write a review about it on the blog or in the post. It is in the brand's interest to be the review as positive as possible, (c) *testing* - influencer can also test the product in a "live broadcast". For example, gradually adding posts with satisfaction with the product or even creating a live video on which he or she is testing the product in a real time. Again, it is in the brand's interest for testing to be accompanied by the most positive influencer comment possible, (d) *contest* - brand sends the product to influencers and asks them to create a contest for the product. This effectively promotes the product and the brand. In addition, influencers like this kind of promotion because it increases the interactions with their content, (e) *social media profile over-take* - this form of promotion requires a considerable level of trust. Influencers inform their followers that for a short period of time they are going to take care of a brand's profile on the social network. The brand entrusts influencers with the login details and lets them create their own content, which often includes product promotion. Influencers thus attract their followers to the brand's social network, which leads to effective growth of the brand's audience, (f) *affiliate* - influencers promote a product of a particular brand in various ways. However, they are rewarded exclusively for the real sales made, (g) *brand ambassador* - influencers may become the face of the brand for a certain period of time for a financial reward. The ambassadors usually promote the brand's product and in a positive sense they regularly comment the product within their communication channels.

**Category “placement”:** (a) *post on social media* - this is the most standard form of cooperation during which influencer publishes a post about a promoted product of the brand within a text or an image, (b) *story on social media* - in addition to posts, social media have recently made it possible to create stories. Influencers can use this format to promote a product in the form of text or image, (c) *video on social media* - another more productively complex form is a video on social media. It can be placed in a post or in a story, (d) *article on a website* - besides social media, many influencers also have their own website. Thus, a promotion of the brand's product can take place on this platform as well.

**Category “reach”:** (a) *organic* – a large base of followers ensures a large organic reach. Many larger influencers do not need to sponsor their promoted posts because the natural impact of their posts is sufficient, (b) *paid* – if the reach of the promoted posts does not meet the set objectives of the brand, the influencer may reach for a paid promotion. Targeting is usually set on people who behave similarly to people who already follow influencer.

**Category “reward”:** (a) *barter* – a barter form of reward is typical especially for smaller influencers, to whom the brand sends the product for a promotion. After publishing a review or other form of cooperation, influencer may keep the promoted product, (b) *finance* – it is typical for larger influencers, whose number of followers usually exceeds 30,000.

For a more effective orientation in the found information the authors present an overview, that creates a taxonomy for the entire segment of influencer marketing (Fig. 2).

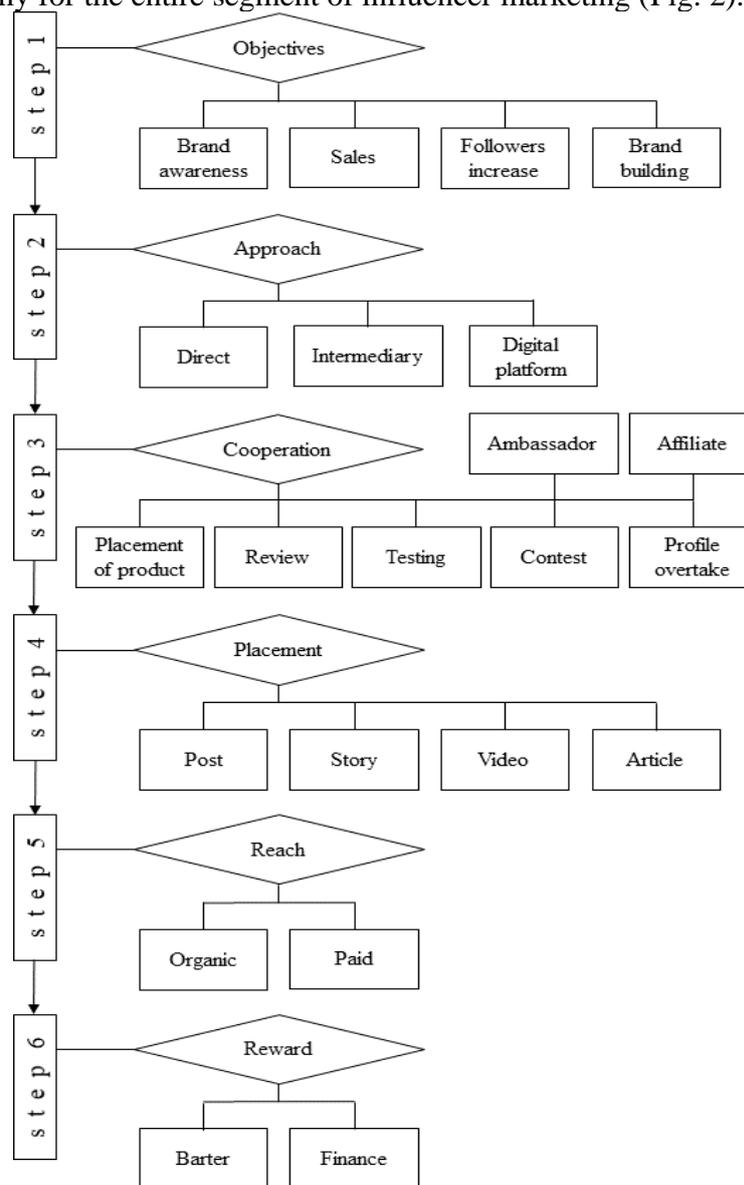


Fig. 2 - Influencer marketing taxonomy. Source: own research

Found information are presented also in form of a process map named Influencer marketing taxonomy (Fig. 1). Researched categories and information within them are lined up in six steps. The steps can serve as guide for marketers during a marketing communication via influencers and also for influencers, who are not oriented in influencer marketing possibilities. Influencer marketing is young discipline and is evolving in time. Thus, information in the process map should be regularly updated.

## 5 CONCLUSION

Influencer marketing is relatively new marketing channel which utilizes influencers within marketing processes. It is similar to celebrity marketing, however, works primary with people popular on social media. In terms of influencer marketing a popularity of a person can be measured by number of fans or followers (depending on a specific social media). The larger fan base the larger interest of companies to cooperate with an influencer. A process of cooperation

with an influencer is often tedious, confusing and demands at least some knowledge about possibilities a company has. The article presents taxonomy in influencer marketing and categorizes whole process into six steps, which a company should get through to reach a successful influencer marketing effect. The steps are designed to name and describe all options of a company within specific steps. The steps define objectives, which can influencer marketing activity reach, options of approaching an influencer, forms of cooperation in terms of a company or a product promotion, placements of influencer where an activity can be placed, types of distribution and reach of followers of an influencer and reward options for an influencer. Declared steps have potential to serve as a recipe for companies, who have intention to utilize influencers as a marketing communication channel. As far as influencer marketing process depends on interaction between at least two people, the process is very flexible and dynamic and is impossible to preset. However, the presented steps might serve as a guideline for a better orientation of a company. Influencer marketing can be very effective communication tool since influencers have impact on a significant number of users and have ability to affect decision making process of a specific audience. However, it is necessary to properly execute the activity to reach desired effects and profitability of such marketing communication.

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# COMPETITIVENESS OF THE REGION: AN EMPIRICAL ANALYSIS OF THE SLOVAK REPUBLIC

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## **Abstract**

Competitiveness is an important area in today's global world. The definition of this term is very different and is influenced by the indicators that explain it. But the common point of the competitiveness explained by various authors is, that it distinguishes regions into more or less successful ones. For this reason, the article deals with the field of competitiveness. The aim of the paper is to identify the position of the Slovak Republic (Slovakia) in the international evaluation of competitiveness. It analyses the position of Slovakia in worldwide competitiveness ranking. Through the period of 8 years, examine the strong and weak competitiveness pillars of GCI and GCI 4.0. Through the comparison with the best evaluated countries show the limits of Slovakia. We used spider graphs and tables for better clarity of the data. The main methods used in this article were analysis and correlation analysis. Subsequently, analyses the impact of youth unemployment and GDP on the competitiveness were made. Unemployment and GDP are the major macroeconomic indicators, that shows the country's health and stability. Based on the results, we can confirm the very strong interdependence between the position of Slovakia in GCI ranking and the youth unemployment. The correlation coefficient is in Hypothesis 2 is statistically significant. So, there is a relationship between the level of GDP per capita and the ranking achieved in the of the Global Competitiveness Index.

**Keywords:** *Competitiveness, GCI, Unemployment, GDP per Capita*

## **1 INTRODUCTION**

In today's global economy, significant changes are taking place. Every economy or region thinking about how to increase its competitiveness, its position in global ranking. A high and rising standard of living, a high and sustainable employment rate, a stable GDP growth rate, stabilized government debt as well as the development of people's potential and innovation are some parameters of a highly competitive economy. If we add to this the leading position of the country in the one of the many world rankings of competitiveness, then the country or region can rightly be described as competitive. However, it is questionable how to understand or explain the competitiveness of the region. How understand this term, what factors influence it and, last but not least, how to quantify and calculate competitiveness.

We try to verify some aspects of competitiveness on an example of Slovakia. We find out that the analyses of the one country, of course, compared to another countries, can show us some conclusions. Especially typical for that country, but as a starting point for further research, it is sufficient.

Many authors (Gonos & Timková, 2017; Cellini & Soci, 1998; Širá, 2018; Širá, Kiseľáková & Šofranková, 2018; Paukovič & Holovčáková, 2008) set the unemployment as the basic macroeconomic factor, which impact on the economic performance, or, in higher values, is a negative product of it. So, we try to verify the impact of the unemployment on the competitiveness. On the other hand, the GDP is the main macroeconomic indicator of the country's economy. So, the second hypothesis check-up the relationship between GDP and competitiveness.

## 2 THEORETICAL BACKGROUND

Many authors examining this issue lead to the definition of competitiveness. The authors mostly focus on the characteristics, that can be observed in the economy, when introducing this concept. It is also important to determine the level the author deals with competitiveness. Whether it is the level of the country or industry, or a specific business entity. The level of research thus influences aspects of defining competitiveness.

The problem of competitiveness in the global economic area is extremely important for any region, especially in the context of globalization of the world economy, where the importance of various forms of external economic relations, the degree of openness of national economies to foreign products, services and capital for national economies is growing rapidly. (Bondareva & Tomčík, 2013)

As Cellini and Soci (1998) point out, the very semantic interpretation of the word competitiveness is complicated. There is no linguistic interpretation of the noun competitiveness, even in the most important English dictionaries, where only the adjective *competitive*, the verb *to compete* and the noun *competition* are defined. The word *competitiveness* is just a derived word. Etymologically, competitiveness probably has its origins in Latin *cumpetere*. The word *petere*, although meaning a certain action, does not mean anything conflicting. But on the contrary, its importance expresses a certain cooperation. The preposition *cum* then has no effect on the meaning of the verb (Slaný et al., 2006).

"Competitiveness can be understood as the ability of a company, industry or country to withstand competition, conflict of business interests with leading companies or countries and ensure at least medium-term prosperity, while the goal is long-term sustainable prosperity." (Štefko, 2001, p. 9). In this definition, the author emphasizes mainly on the future, e.g. medium term, or long-term sustainable prosperity as a result of the company's competition.

According to the World Economic Forum, national competitiveness is a set of institutions, policies and factors, that determine a country's productivity level (Schwab, 2012, Schwab & Porter, 2007). This is how this area is understood in the context of the Global Competitiveness Index (GCI). This definition connects companies with the country in which they operate. Competitiveness at the country level in a given context represents the company's ability to compete, grow and be profitable (Martin, Kitson & Tyler, 2012; Annoni, Dijkstra & Gargano, 2017). However, applying the same concept to countries or regions has provoked criticism because a country or region cannot leave business. In this regard, it is not possible to assess the same meter for the country's economy and corporate governance.

In addition, competition between countries can be a positive summary game, while competition between companies is usually a zero-sum game (Krugman, 1996). Other authors agree that the region is neither a simple aggregation of firms nor a reduced version of nations (Gardiner, Martin & Tyler, 2012). Meyer-Stamer (2008) and Annoni, Dijkstra and Gargano (2017) state that the (systemic) competitiveness of a territory can be defined as the ability of a locality or region to generate high and growing incomes and improve the livelihoods of the inhabitants. However, this definition is entirely based on the benefits for people living in the region and does not assess the strengths and weaknesses of companies. (Kiseľáková, Širá & Šofranková, 2017)

### **Global Competitiveness Index GCI**

The measurement of competitiveness can be approached from several perspectives. The Global Competitiveness Index (GCI) published annually by the World Economic Forum is also used to assess a country's competitiveness.

For more than three decades, the World Economic Forum has been an institution dealing with the field of competitiveness and its quantification. The Annual Global Competitiveness Reports compare many factors in the field of national competitiveness. From the outset, the aim of this report has been to provide information and stimulate growth among all the regions involved, to show them their weakest areas and, at the same time, to help the regions overcome obstacles to increasing competitiveness, using various strategies. At present, given the challenging economic environment, the priority is to focus on sustainable growth. (Schwab, 2013)

As for the development of the index, since 2005 the initial index has been supplemented and revised by Xavier Sala and Martin in cooperation with the World Economic Forum (Schwab, 2016). This innovated report is thus one of the most comprehensive sources of information on the comparative advantages of economies around the world.

The World Economic Forum understands competitiveness as a set of institutions, policies and factors that determine a country's level of productivity (Gonos & Timková, 2017). The level of productivity determines the degree of prosperity that is achieved in the economy. The concept of competitiveness therefore contains both a static and a dynamic element. Although a country's productivity determines its ability to achieve a higher level of income, it is one of the key factors in the return on investment, which is also a key factor for the country's potential growth (Schwab, 2013).

Many indicators affect productivity and competitiveness (Dudáš & Cibul'a, 2018). The most important factor of competitiveness cannot be identified with certainty. Therefore, when assessing competitiveness, it is good to consider several factors and on the basis of them determine the final value for the examined country.

In the case of the Global Competitiveness Index, due to the complexity of the outputs included in the observation, several indicators are included. The GCI index (until 2017) consists of more than 100 indicators divided into 12 pillars. These 12 pillars are divided into 3 sub-indexes. (Schwab, 2016)

#### **New Global Competitiveness Index GCI 4.0**

With the approach of the 4th Industrial Revolution, attention is focused on the aspect of humanism and the area of human resources (Bryukhovetskaya & Chernykh, 2020). This revolution has become a reality for millions of people around the world and has created new opportunities for businesses, governments and individuals. At the same time, however, it threatens a new divergence and polarization within economies and societies. This 4th industrial revolution, together with the consequences of the economic crisis a few years ago, redefines the ways in which prosperity is achieved. In this context, the World Economic Forum had to make some adjustments and incorporate these facts into the competitiveness index. After more than 40 years of experience in comparing the competitiveness of the world's countries, the GCI index has been adjusted - to the Global Competitiveness Index 4.0 (GCI 4.0). (Schwab, 2018)

With the concept of the 4th Industrial Revolution, the World Economic Forum contributes to global thinking and policy-making by including it in the definition of competitiveness (Bal & Erkan, 2019). The index thus integrates proven aspects with new and emerging attributes that increase productivity and growth. It emphasizes the role of human capital and innovation, which are not only a driving force, but also define the signs of economic success in the 4th Industrial Revolution (Dudáš & Cibul'a, 2018).

Regarding the calculation of the new GCI 4.0 index itself, there has also been a change in the maximum possible achieved values. At present, it is possible for the evaluated country to achieve points in the range of 0-100, which is a significant methodological change compared

to the previous result of the GCI index, when it was possible to obtain a maximum score of 7 points (Šušić, Šušić & Dragić, 2019).

This new approach emphasizes that competitiveness is achievable for all countries. In 2018, a total of 98 indicators were included in the GCI 4.0 index, which is 16 indicators less than before. However, in 2019, the number of indicators increased to 103 (Schwab, 2019). These indicators and their values are determined on the basis of data from international organizations and a survey by the World Economic Forum. The indicators are again organized into the 12 pillars of the GCI 4.0 index, reflecting the extent and complexity of the drivers of productivity and competitiveness (Schwab, 2018).

If we compare the original 12 pillars of GCI, in the current assessment, there is not the area of higher education and training, which may be partially covered by the area of skills in GCI 4.0. Apart from this area, the new GCI 4.0 index does not include the areas of technological readiness and sophistication of business. However, the new GCI 4.0 index also includes a skills pillar and ICT pillar.

### 3 METHODOLOGY

The aim of the paper is to identify the position of Slovakia in the international evaluation of competitiveness. To better evaluate the current position of Slovakia, we have chosen an international comparison, which includes many countries around the world. This is due to a more objective assessment of the country's position and the identification of the region's strengths and weaknesses in international comparison. For this reason, we chose the World Economic Forum's approach to assess competitiveness through the GCI index, which was the main source of information on the country's competitiveness. This GCI competitiveness index has undergone a more significant change in the recent period, which has been reflected in the innovated calculation methodology, maximum score and number of input indicators. For this reason, we also dealt with the characteristics and comparison of the GCI and GCI 4.0 indices in the theoretical basis.

In the period 2012 - 2019, we analysed the achieved scores and the position of Slovakia in the international comparison of the World Economic Forum. Subsequently, in the last analysed year, we used the Spider chart to point out the position of Slovakia in the individual pillars of GCI 4.0 in comparison with the best rated country in the world. In this type of graph, the strengths and weaknesses of Slovakia in comparison with the best country in the world are visually recognizable.

Finally, we examined whether or not the selected indicators have an impact on the country's competitiveness. Based on previous studies (Širá, 2019; Širá, Kiseľáková & Šofranková, 2018; Širá, 2018), we selected unemployment, specifically youth unemployment and GDP, specifically GDP per capita. We have established the following hypotheses for these selected indicators.

*Hypothesis 1: We assume that there is a relationship between the level of youth unemployment and the country's competitiveness.*

H0: We assume that the dependence between youth unemployment and the country's competitiveness is not statistically significant.

H1: We assume that the dependence between youth unemployment and the country's competitiveness is statistically significant.

Based on the hypothesis formulated in this way, we compare the dependence between these two variables: (1) placing the country in the competitiveness ranking (GCI index), (2) youth unemployment (15-25 years).

*Hypothesis 2: We assume that there is a statistically significant relationship between the level of GDP per capita and the competitiveness of the country.*

H0: There is a statistically significant relationship between the level of GDP per capita and the ranking achieved in the Global Competitiveness Index (GCI).

H1: There is no statistically significant relationship between the level of GDP per capita and the ranking achieved in the Global Competitiveness Index (GCI).

Based on the hypothesis formulated in this way, we compare the dependence between these two variables: (1) achieved ranking in the Global Competitiveness Index (GCI), (2) GDP per capita.

The necessary data on selected indicators were drawn from the Eurostat database. We used the Statistica 12 program for statistical verification of dependencies.

## 4 RESULTS

Table 1 show the development of the ranking and achieved score of Slovakia in the ranking of competitiveness according to the Global Competitiveness Index (GCI). This ranking assesses the overall competitiveness of the country for the period 2012-2019.

Tab. 1 – Ranking and score of Slovakia in GCI and GCI 4.0. Source: own research

	2012	2013	2014	2015	2016	2017	2018	2019
<b>Number of countries</b>	144	148	144	140	138	137	140	141
<b>Ranking of Slovakia</b>	<b>71</b>	<b>78</b>	<b>75</b>	<b>67</b>	<b>65</b>	<b>59</b>	<b>41</b>	<b>42</b>
<b>Score (Sc.)</b>	<b>4.1</b>	<b>4.1</b>	<b>4.15</b>	<b>4.22</b>	<b>4.28</b>	<b>4.33</b>	<b>67</b>	<b>67</b>
<b>Max. score</b>	7	7	7	7	7	7	100	100
<b>Achieved Sc/max. Sc.</b>	58.6%	58.6%	59.3%	60.3%	61.1%	61.9%	67%	67%

In the analysed period, Slovakia improved its position every year. The worst place in the ranking was in 2013, when it was ranked 78th out of a total of 148 countries evaluated. The biggest movement across the positions occurred between 2017 and 2018, when Slovakia moved from 59th place to 41st.

If we take a closer look at the development of the score obtained in the GCI index and in the context of the maximum values, we can see, that Slovakia's competitiveness has been increasing throughout the period under review. Although, this may not have reflected the better placement of the country, but its points converted to % of the maximum score have an increasing tendency. Thus, we can say that Slovakia has constantly improved its competitive position.

Singapore became the leading country in 2019. So, we find important, to compare the results of Slovakia with the results of best country in this GCI ranking in 2019. Because it is important to learn from the best. With this country, we have obtained the most similar results in the pillars of macroeconomic stability and skills. The most significant differences, however, are to look at the ability of innovation and the commodity market in the pillars.

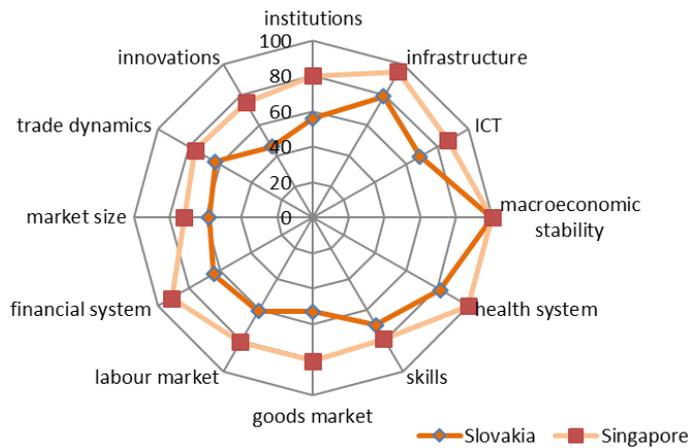


Fig. 1 – Slovakia compared with the best country of GCI in 2019. Source: own research

Furthermore, we present the values of individual pillars of the GCI 4.0 index obtained by Slovakia in 2019. In the figure below, we can see that Slovakia reached values up to the maximum level in some areas, and in some areas the values were even lower than 50 points. From this inequality development of Slovakia's competitiveness, we have the task of focusing in more detail on the strengths and weaknesses of the country.

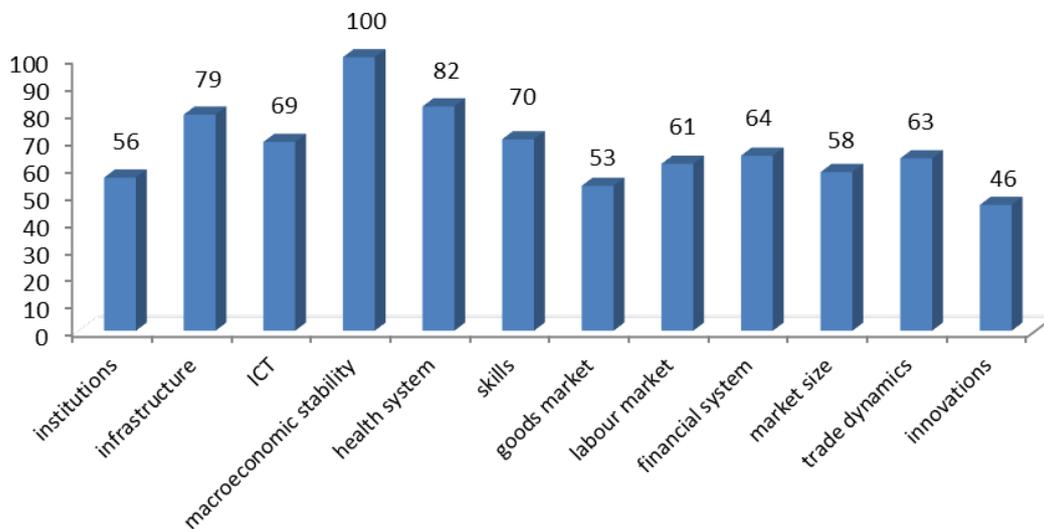


Fig. 2 – Pillars of GCI 4.0 and obtained values of Slovakia in 2019. Source: own research

Macroeconomic stability and health care were identified as the strongest areas of Slovakia's competitiveness in the GCI 4.0 index in 2019. In both mentioned pillars, values above the limit of 80 points were achieved. In the area of macroeconomic stability, the indicators of inflation and debt were examined in particular, while the resulting value of this indicator moved our country to 32th place among the 140 evaluated countries.

The most problematic area of the new GCI 4.0 index in 2019 was the area of the last pillar, namely innovation capacity. In 2019, the value of 46 points was achieved in this pillar, in 2018 it was 47 points. In both years, however, it was the only pillar where the values were below 50 points. If we compare the outputs in this pillar with the best, then the leader is Germany.

Our weakest pillar was the 12th pillar called the "innovative capacity of the country". The leader in this pillar was Germany in 2019, so we find important, to compare the results of Slovakia with the results of best country in this pillar. So, the figure shows a comparison of our achieved values with Germany. It is clear to see in which sub-indicators we have the largest reserves. If

we look at these results from the opposite side, it is positive that achieve the values similar as the Germany in terms of the number of scientific publications and trademark applications.

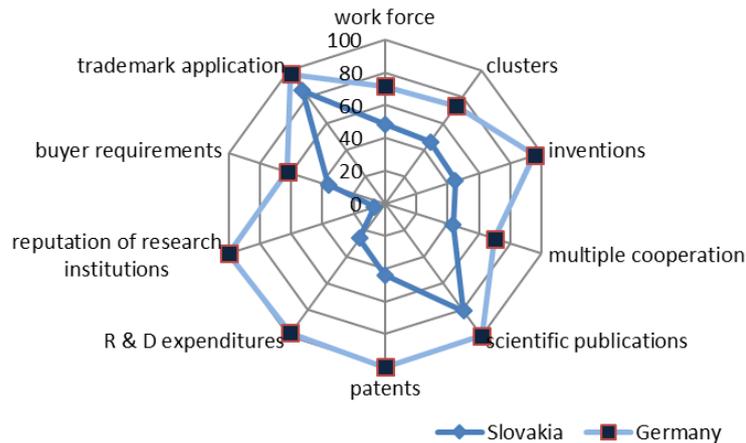


Fig. 3 – The weakest pillar of Slovakia compared with the best country in 2019. Source: own research

In the labour market, young people are considered to be the most vulnerable group, so this age group was chosen for comparison. Youth unemployment is a very serious problem. The main aim of this section is to verify the relationship between the country's location in the GCI index and youth unemployment. We have formulated the following hypothesis for this problem.

*Hypothesis 1: We assume that there is a relationship between the level of youth unemployment and the country's competitiveness.*

H0: We assume that the dependence between youth unemployment and the country's competitiveness is not statistically significant.

H1: We assume that the dependence between youth unemployment and the country's competitiveness is statistically significant.

Based on the hypothesis formulated in this way, we compare the dependence between these two variables: (1) placing the country in the competitiveness ranking (GCI index), (2) youth unemployment (15-25 years).

We tested the hypothesis on the example of Slovakia. We analysed data for the period from 2011 to 2018.

The unemployment rate of young people in the age group from 15 to 25 years was not quite optimal in Slovakia. What is positive, however, is its markedly declining trend in recent years. At the beginning of the period under review, the value of this indicator exceeds the average value of youth unemployment in the EU. The high values of this indicator are partly due to the higher unemployment rate in the country, as well as the partial discrepancy between supply and demand in the labour market and the unwillingness of young people to move to work within the country. On the positive side, however, this value has been on a declining trend since 2012 and has almost reached the average value of this indicator for the countries of the European Union in the last year.

Tab. 2 – Young people unemployment as % of active population. Source: own research

	2011	2012	2013	2014	2015	2016	2017	2018
<b>EU 28</b>	21.7	23.3	23.7	22.2	20.3	18.7	16.9	15.2
<b>Slovakia</b>	33.7	34.0	33.7	29.7	26.5	22.2	18.9	14.9

In verifying the dependence, we proceeded from the established hypothesis that there is a dependence between the country's position in the GCI index and the level of youth

unemployment. We examined how and whether the unemployment of the most endangered group of the population, young people aged 15 to 25, affects the country's competitiveness in terms of ranking in the World Economic Forum. We used the Statistica 12 statistical program to verify the dependence.

The result of the correlation analysis is the coefficient  $r$ , which acquired the value 0.876174. Since this value of the coefficient is higher than 0.8, we can confirm the very strong interdependence. In addition, the  $r$  coefficient has a positive value, so it indicates a direct linear dependence between the variables, which can be observed in Figure 4.

The estimated shape of a simple linear model is as follows for these variables:

$$GCI = 28,983 + 1,3724 * \text{youth unemployment} \quad (1)$$

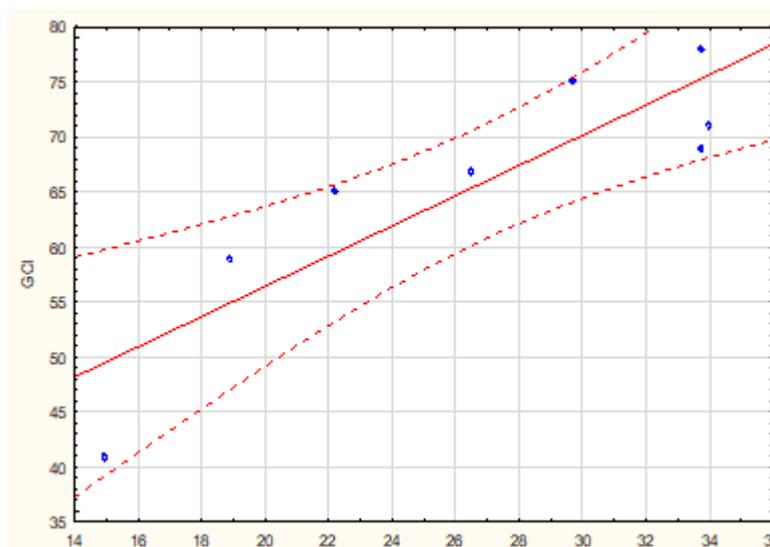


Fig. 4 – Interdependence between competitiveness and youth unemployment. Source: own research

The achieved value of  $p$  was 0.175. In this case, the  $p$ -value is greater than the significance level of 0.05. Based on this, the hypothesis of the existence of a statistically significant dependence cannot be rejected.

We also examined the impact of another macroeconomic indicator on the country's competitiveness, namely GDP. We have formulated hypothesis 2 as follows:

*Hypothesis 2: We assume that there is a statistically significant relationship between the level of GDP per capita and the competitiveness of the country.*

H0: There is a statistically significant relationship between the level of GDP per capita and the ranking achieved in the Global Competitiveness Index (GCI).

H1: There is no statistically significant relationship between the level of GDP per capita and the ranking achieved in the Global Competitiveness Index (GCI).

Based on the hypothesis formulated in this way, we compare the dependence between these two variables: (1) achieved ranking in the Global Competitiveness Index (GCI), (2) GDP per capita.

Tab. 3 – Pearson's correlation coefficient. Source: own research

	Correlation coefficient / $\rho$	Dependence $\rho$	p - value	Correlation type
Slovakia	- 0.98787719	Indirect	0.0016	Trivial

When verifying hypothesis H2, the p-value was  $<0.05$ , so we reject hypothesis H0 and accept hypothesis H1. The correlation coefficient is statistically significant in Slovakia. There is a relationship between the level of GDP per capita and the ranking achieved in the ranking of the global competitiveness index. The correlation is trivial under the given conditions. We can also see an indirect dependence between the variables.

## 5 DISCUSSION

In the monitored period, Slovakia improved its position in the evaluation of competitiveness every year. The largest movement in positions were occurred between 2017 and 2018, when Slovakia moved from 59th to 41st. This significant movement was not caused by a sharp change in the number of countries analysed, but was mainly influenced by a change in methodology. When, from 2018, the original GCI index was replaced by the new GCI 4.0. This change was also supported by a change in the key pillars in the competitiveness study. Thus, we can conclude that the movement in the area of analysed indicators, or even the addition of new areas to the evaluation helped us significantly in the overall ranking. Of course, the development of the economy must not stagnate, and the country must have a healthy economy in order to defend such leading positions in the future.

From the above results of the comparison of Slovakia and the most competitive country in 2019, we can notice one fact. That even though the country has the best overall values of the GCI, or GCI 4.0 may not be the leader in every of the analysed pillars. Each pillar could reach a maximum of 100 points. From the Figure 1 we can notice, that even the leading countries had greater or lesser problems with achieving the maximum possible values in the pillars. Thus, the best country does not have to have values of around 100 points in all analysed pillars.

## 6 CONCLUSION

Macroeconomic stability and health care were identified as the strongest areas of Slovakia's competitiveness in the GCI 4.0 index in 2019. In both mentioned pillars, values above the limit of 80 points were achieved.

The most problematic area of the new GCI 4.0 index was innovation capacity. This pillar includes the areas of cooperation and diversity, research and development, as well as the area of commercialization. The best values are achieved in the indicator of the number of scientific publications and in the trademark. These are the only 2 areas of this pillar, where values higher than 50 points are achieved. In all other indicators, the values are less than 50 points.

In the labour market, young people are considered to be the most vulnerable group, so this age group was chosen for comparison. Youth unemployment is a very serious problem. Firstly, because people aged 15 to 25 have a fairly significant percentage of the total unemployment rate. Furthermore, because this group is the most endangered group, because graduates without work experience have a very difficult position in the labour market. Another, no less important factor is work habits. If young people do not enter the labour market after leaving education and do not start working, they will not acquire work habits and, over time, it will be more difficult to include them in the work process. Another factor that threatens this group of people, in addition to the lack of experience, the absence of work habits is the absence of employer-required experience. The difficulties associated with gaining experience are associated with the overall situation in our labour market. (Paukovič & Holovčáková, 2008)

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# THE BREXIT REFERENDUM AND ITS CONSEQUENCES ON SELECTED MACROECONOMIC INDICATORS IN THE UNITED KINGDOM: A SYNTHETIC CONTROL METHOD APPROACH

*Agáta Šuláková*

## Abstract

One of the most discussed topics among economists has been the Brexit referendum, and its consequences, benefits, and disadvantages not only for the UK but also for the EU as a whole. We examined the effect of the Brexit referendum using the method of synthetic control groups. This method enabled us to compare the performance of the UK economy with a combination of countries that did not hold a referendum on leaving the European Union. We constructed the synthetic UK as a synthetic control unit from a donor pool. The donor pool in our model consisted of 27 actual member states of the European Union. Our approach left us with 28 countries and yearly observations for the period from 2002 to 2019 for GDP per capita, and for period from 2008 to 2019 for export and import. Our main assumption was that the UK has been the only country directly affected by the treatment. The results indicated that the Brexit referendum significantly weakened GDP per capita in the UK. It is noteworthy that the difference between actual GDP per capita in the UK and the synthetic one, could be observed since 2015. It was a year before the referendum itself. We reached similar results for the models, dealing with the UK export and import and hence if there was no referendum in the UK, export and import would be considerably higher.

*Keywords:* Brexit, United Kingdom, GDP per capita, export, import, European Union, synthetic control method

## 1 INTRODUCTION

On the 23rd June 2016, the citizens of the United Kingdom chose to leave the European Union in a referendum. However, this referendum was not the first of its kind. In 1975, a referendum was held in the United Kingdom on the United Kingdom's membership in the European Economic Community. The citizens of the United Kingdom voted to maintain the membership. First attempt to withdraw from this union can be traced back to 1973. It was the year in which United Kingdom officially joined the European Economic Community.

A few weeks after the referendum in 2016, the Bank of England announced not very promising prospects for the economy. The period following the referendum was accompanied by uncertainties on future developments especially in the labour market and international trade.

## 2 THEORETICAL BACKGROUND

Since the issue of the Brexit referendum and the withdrawal of the country from the European Union has been relatively new, the review of the literature on the consequences of Brexit referendum could be described as far from comprehensive. In this brief review, selected studies dealing with referendum through the method of synthetic control method would be summarised.

Born in his article from 2019 dealt with the Brexit referendum and the subsequent quantification of its impact on the disintegration of the economy. The study found that the Brexit referendum had a significant impact on economic performance of the United Kingdom. The results suggested that, because of the referendum itself, GDP fell by 1.7% to 2.5 % at the end of 2018.

They also observed a decline in consumption and investment because of changing expectations. The cumulative loss to GDP was more than 55 billion pounds. In their model they used quarterly data from 1995Q1 to 2016Q2. As a donor sample they used 23 OECD countries, in which there was no referendum on leaving the European Union. The variables in their model were consumption, investment, export, import, labour productivity growth and employment rate. In the second half of 2016, there was almost no significant change in these macroeconomic indicators. The first noticeable consequences of the referendum did not manifest themselves until the first quarter of 2017. The referendum therefore had to cause a change in expectations, and these changes in expectations affected the development of the economy before the actual implementation of Brexit. These changes in indicators could also have been caused by increased political uncertainty. (Born, 2019)

Breinlich (2020) analysed the results of the British referendum on leaving the European Union through foreign direct investment. They used the synthetic regression method and observed a 17 % increase in the amount of investment from the UK to the remaining Member States of the European Union by March 2019. The increase in investment was worth 21.2 billion pounds and was mainly due to an increase in investment within services. A remarkable observation would be that the investment to the non-European Union countries, which were member countries of OECD stayed unchanged. These results should confirm the hypothesis that UK companies were setting up subsidiaries to maintain access to the European Union market even after the Brexit referendum. Also, this study showed that investment from the 27 EU Member States to the UK have fallen by 9 % by 2019. Increase in the UK investment in the countries of the EU was not accompanied by an increase in foreign investment to the non-member states. The model is based on data from the first quarter of 2010 to the first quarter of 2019. The observations used about 100,000 investment transactions. (Breinlich, 2020)

Douch et al. (2018a) analysed Brexit referendum's implications for trade between the United Kingdom and 14 trading partner countries that are members of the European Union and between the United Kingdom and 14 trading partner countries outside the European Union. They used synthetic control method. Among the biggest findings of the study was that the actual UK export was comparatively lower than synthetic export. Applying the synthetic control method model, they noticed a decrease in import into the United Kingdom from selected EU member states. However, imports into the UK from non-member countries remained almost unchanged. The exceptions in this case were the Commonwealth countries, in particular New Zealand, whose export to the UK increased during this period. The study covered period from January 1999 to March 2018 and applied monthly data. The variables employed consisted of GDP expressed in dollars and the exchange rate. The data have been seasonally adjusted. (Douch et al., 2018a)

Douch et al. (2018b) also analysed the impact of the Brexit referendum on export of the United Kingdom. He used the synthetic regression method. The results showed that export after the Brexit referendum was lower than synthetic export in the period under the review. This might suggest that political and economic uncertainty might have also affected export in sectors not normally covered by EU tariffs. They used monthly data on export of commercial services in dollars for 21 countries from the beginning of 2008 to March 2018. Exported commercial services were calculated as all exported services minus exported government services. In addition to the export of services, they also included the exchange rate and GDP in the model. (Douch et al., 2018b)

In his study from 2018 Crowley constructed a model that estimated that 5 200 UK's companies did not start exporting new products to the EU after referendum in 2016. He also found that around 4 000 companies stopped exporting products to the EU, that were previously exported before referendum. Export would have been higher by around 5.1 % in 2016 if companies

exporting from the United Kingdom had not been exposed to an increased trade policy uncertainty. (Crowley, 2018)

The study written by Saia did not analyse the outcomes of the UK leaving the EU but the potential adoption of the euro in the United Kingdom among other countries in 1999. The model is focused on the possible development of the UK economy and trade if the country joined the monetary union. The method used in this study was once again the synthetic control method. It placed emphasis on the estimation of the trade flows that would arise between the UK and its main trading partner countries. The results suggested that aggregate trade flow between the European Union and UK would have been around 16 % higher if the United Kingdom had adopted the common currency in 1999. Their second result indicated that if the UK adopted the euro at the initial stage in 1999, the trade of the country with third countries would have increase by 15 %. (Saia, 2017)

Dhingra in his paper from March 2016 has estimated the economic consequences of leaving the European Union. According to his findings, the consequences will depend on what policies the UK will adopt. He also estimated that lower trade due to the reduced integration with member countries in the European Union is likely to cost the UK economy more than is gained from lower contributions to the common budget in the European Union. The estimated the effect of Brexit on trade and the UK's contribution to the common budget would be around 1,3% - 2,6%, which is from 850 to 1700 pounds per household per year. He also estimated a decline on productivity, which may cause a decline in income from 4200 to 6400 pounds per household per year. (Dhingra, 2016)

According to Chang, Brexit will surely have impact on the economy of the European Union and the economy of the United Kingdom. The consequences are uncertain, and they will depend on the negotiation outcomes of a host of issues and the trade regime to be realised. (Chang, 2018)

### **3 METHODOLOGY**

Following (Abadie & Gardeazabal, 2003), (Abadie et al., 2010), (Abadie et al., 2015) and using the synthetic control method we created a synthetic United Kingdom. Our assumption was that the actual United Kingdom would have developed as the synthetic United Kingdom if there was no valid Brexit referendum. We could quantify the costs of this referendum as the difference between actual UK's performance and the synthetic UK's performance.

We constructed the synthetic UK as a synthetic control unit from a donor pool. In the donor pool we included 27 actual member states of the European Union. Unlike previous studies (Born, 2019), (Breinlich, 2020), (Douch, 2018) we did not add non-EU countries to the model since these countries could not hold a referendum on leaving the EU. The donor pool consisted only of countries that, like the United Kingdom, were still members of the European Union in 2016. Our approach left us with 28 countries and yearly observations for the period from 2002 to 2019 for GDP per capita, and for period from 2008 to 2019 for export and import. Data for export and import were expressed as current prices in million euro. GDP per capita was expressed in current prices and euro per capita. The UK was the only country directly affected by the treatment. Our sample encompassed the UK and 27 European countries, namely Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland and Sweden.

Our procedure assumed that a possible treatment effect materialised after 2016. The sample was divided into two periods: a control period before referendum, and a treatment period, after

the referendum. The synthetic UK was expressed as a weighted average of the countries in the donor pool. The weights were determined by minimising the distance between macroeconomics indicators of the actual UK and the macroeconomic indicators of the synthetic UK prior to the treatment. Our data – GDP per capita, export and import were taken from the Eurostat Database.

Vector X1 was a set of characteristics of the United Kingdom, as the observed country, in the period before the change. In our model the year of change was the year 2016. The vector X1 contained exogenous variables which could explain the macroeconomic indicators in the United Kingdom. Matrix of identical variables X0 was describing macroeconomic indicators in the control group. In our model the control group included 27 European countries which would be used to construct the synthetic United Kingdom. This method searched for a set of weights W on a set of control countries. Moreover, it minimised the difference between the model estimate and the actual economic performance of the United Kingdom in the period before 2016 defined by the expression  $(X_{1} - X_{0} W)V(X_{1}-X_{0} W)$ . The permissible interval for the weights of the individual countries was in the range  $\langle 0,1 \rangle$  and the sum of the weights in the vector W was equal to 1. Vector V and the vector W minimised the estimation error between the synthetic estimate and the actual development in the preintervention period. Combining the vector of weights W and the matrix Y0 we could obtain the counterfactual estimate in the postintervention period, and it contained the values of the variables of the control group in the post referendum period. By comparison of the actual development in the United Kingdom and the contractile estimate based on the synthetic control method, we were able to get the effect of the intervention. In our paper, the effect of the intervention was the effect of the Brexit referendum on the selected macroeconomic variables in the United Kingdom.

#### 4 RESULTS

##### Impact of the Brexit referendum on GDP per capita in the United Kingdom

The results indicated that the Brexit vote has already had a substantially negative impact on the UK macroeconomic performance. As seen in the Fig. 1, actual GDP per capita was lower than the synthetic indicator. Also, the gap between the actual and synthetic GDP per capita had been widening. However, it did not take place in the referendum year of 2016 but as early as 2015. This might be due to David Cameron (the then Conservative leader) responding to the increasing demand to leave the EU and promising to call a referendum on the withdrawal of the UK from the EU ahead of the 2015 parliamentary elections.

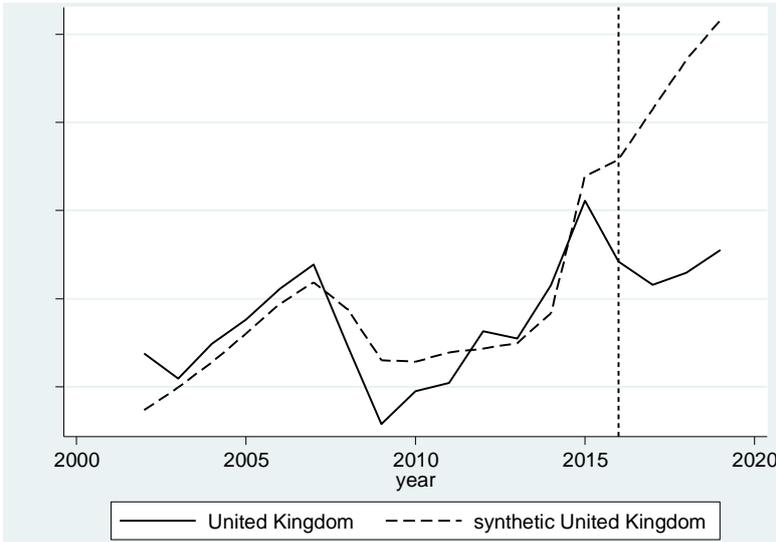


Fig. 1 – Actual and synthetic GDP per capita UK. Source: own research based on data from Eurostat Database

The synthetic UK was the weighted average of countries in the donor pool. Ireland and Italy were assigned the largest weights. The weight of Ireland was 0,534 and the weight of Italy was 0,404. Together they accounted for more than 93 % of the synthetic UK’s dynamics. Smaller contributions were from Hungary 0,054 and Sweden 0,009.

We could quantify the costs of the Brexit vote by the gap between actual and synthetic GDP per capita. As seen in Tab. 1, the gap between the actual and synthetic GDP per capita widened in the period from 2016 to 2019. The difference between these two indicators was around 5816,89 euro per capita, while in 2019 this difference was almost 13043,47. Assuming that there was no Brexit referendum our model estimated that GDP per capita would be around 50803,47 euro in 2016.

Tab. 1 – Actual and Synthetic GDP per capita UK. Source: own research

Year	Actual GDP per capita	Synthetic GDP per capita
2016	37 090	42 906,89
2017	35 780	45 751,73
2018	36 480	48 558,22
2019	37 760	50 803,47

**Impact of Brexit referendum on export in the United Kingdom**

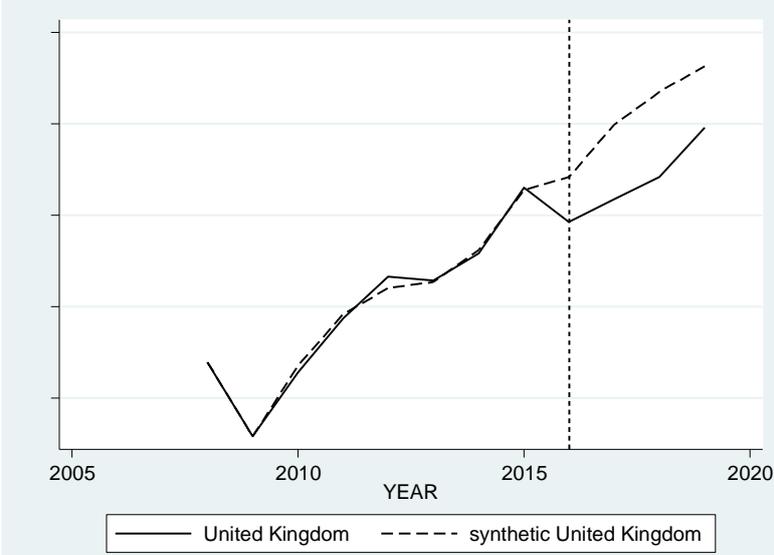


Fig. 2 – Actual and synthetic export in the UK. Source: own research based on data from Eurostat Database

It could also be noticeable, that the gap between actual and synthetic export of the UK widened a year before the official referendum. The synthetic export of the UK was the weighted average of countries in the donor pool, which consisted of 27 European countries. Germany and Poland were assigned the largest weights in this case. The weight of Germany was 0,406 and the weight of Poland was 0,346. There were also contributions from Ireland with weight of 0,24 and Slovakia with 0,007.

Having estimated the gap between actual and synthetic export, we could observe that this had been widening since 2016. This could also be seen in in Tab. 2. In 2016 the actual export of the UK was 692 511,11 million euro, and the synthetic export was 741 959,4 million euro. The difference was 49 448,3 million euro. This difference was much higher 3 years after the Brexit referendum, almost 67 474,94 million euro. Under the assumption of no Brexit referendum our model predicted that in 2016 export of the United Kingdom would be 863 385,04 million euro.

Tab. 2 – Actual and synthetic export United Kingdom. Source: own research

Year	Actual export	Synthetic export
2016	692 511,1	741 959,4
2017	717 584,7	799 183,19
2018	742 026,2	835 029,49
2019	795 910,1	863 385,04

### Impact of Brexit referendum on import in the United Kingdom

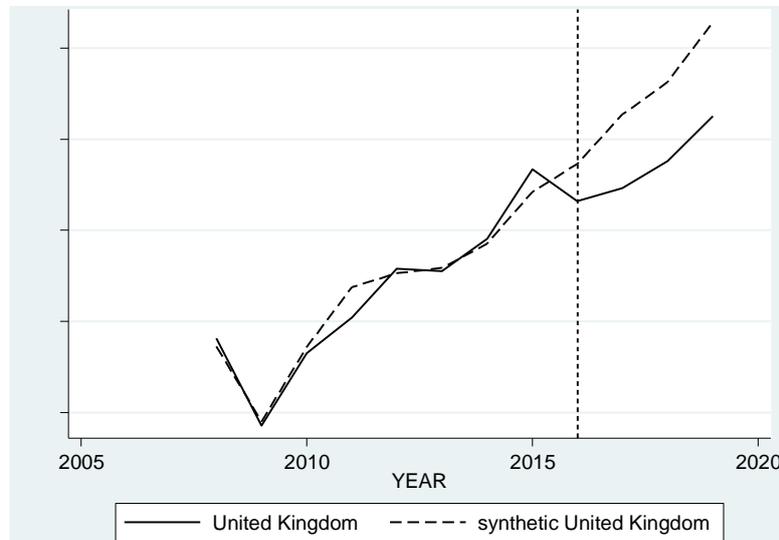


Fig. 3 – Actual and synthetic import in the UK. Source: own research based on data from Eurostat Database

As seen in Fig.3, the gap between the actual and synthetic import of the United Kingdom started to widen in 2015. As we showed before, this was also the case with GDP per capita and export. The difference between the actual import and the synthetic import of the UK increases in the period 2016-2019. The gap between these two indicators in the first year was only about 40 877,35 million euro. The gap in 2019 was almost 102 804,75 million euro. Assuming that there was no Brexit referendum in 2016 and based on our model, import of the United Kingdom would be 928 215,75 million euro.

Tab. 3 – Actual and synthetic import United Kingdom. Source: own research

Year	Actual import	Synthetic import
2016	731 954,4	772 831,76
2017	746 246,6	827 166,87
2018	775 694,9	862 710,86
2019	825 411	928 215,75

There are only two European countries, which contributed to the synthetic UK's import. The biggest contribution was from Germany with weight 0,526 and from Ireland with weight of 0,474.

## 5 DISCUSSION

Our study suggested that the Brexit referendum had a significant impact on economic performance of the United Kingdom. Unlike previous studies we mentioned in literature review, such as (Born, 2019) and (Breinlich, 2020), we came to the conclusions that these changes in the macroeconomic indicators, especially in GDP per capita, export and import, took place before the country's official withdrawal from the European Union. We observed the beginning of the widening of the gap between actual and synthetic UK's performance in

selected macroeconomic indicators in 2015. To confirm these findings, our model would have to include more variables for a longer period of time. Also, placebo tests would have to be performed in further research.

## 6 CONCLUSION

This paper provided a number of preliminary results. However richer data sets and more rigorous estimation methods would be needed to improve our understanding of the impact of the Brexit referendum, which proved to have important implications for macroeconomic policies not only in the United Kingdom but also in other European countries.

We examined the effect of the Brexit referendum using the method of synthetic control groups. This method compared the performance of the UK economy to a combination of countries that did not have a referendum on leaving the European Union. We constructed the synthetic UK as a synthetic control unit from a donor pool. There were 27 actual member states of the European Union in the donor pool in our model. Our approach left us with 28 countries and yearly observations for the period from 2002 to 2019 for GDP per capita, and for period from 2008 to 2019 for export and import. The results showed that the Brexit referendum significantly weakened GDP per capita in the UK. It is worthy to note that the difference between actual GDP per capita in the UK and the synthetic one, could be observed for the first time in 2015. It was a year before the referendum itself. We reached similar results for the models, which studied the UK's export and import. If there was no referendum in the UK export and import would be considerably higher.

### Acknowledgement

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# DIGITAL TRANSFORMATION IN ADVERTISING: THE CASE OF PROGRAMMATIC ADVERTISING

*Tran Van Hai Trieu*

## **Abstract**

The explosion of Industry 4.0 has been happening in this era, and it is an opportunity for any fields or industries to deploy the new technologies for business development; for example, big data, internet of things, artificial intelligence, data management platform, cloud, and blockchain. Advertising field has significantly changed because high technology is applied in digital advertising that it replaces traditional advertising. Also, digital advertising is becoming increasingly important when it uses the new algorithm-based way of advertising, known as programmatic advertising, which is the automated buying and selling of online advertising. Thus, the purpose of the paper is to analyse the role of programmatic advertising is in the advertising field including the functions of programmatic advertising, differences between programmatic advertising and traditional advertising, and determination of the opportunities and challenges facing a digital transformation in advertising. The designed research focuses on the approach involves analysis and review of the integrative literature, which is a form of research including review, critique, and synthesis of related literature following a generated integrative topic with the new framework and perspective. The finding of the study helps researchers and practitioners who are interested in this field have a deeper understanding of programmatic advertising. The limitation of this paper is not possible to consider all problems related to digital transformation in the advertising field, so further research needs to have many empirical studies that find the impacts of programmatic advertising on specific areas.

**Keywords:** *Digital Transformation, Advertisement, Programmatic Advertising, Big Data, Artificial Intelligence, Creative Industry*

## **1 INTRODUCTION**

The 4.0 technology revolution has made the great breakthroughs by applying new technology of fields and industries. Among the most important technologies are big data, internet of things (IoT), artificial intelligence (AI), data management platform (DMP), cloud, blockchain, and so on. The advertisement field in the creative industry is no exception; it has undergone digital transformation from traditional advertising to digital advertising by applying new technology. Such transformation brings many benefits to related parties, such as advertisers, agencies, and publishers.

One of such newly adopted advertising technology is a programmatic advertising platform, which identifies the optimal way of promoting a given product. It can execute, evaluate, manage, and optimize display advertising campaigns in real-time (González & Mochón, 2016). Programmatic advertising also delivers the right advertisement at the right time in front of the right person (Grece, 2016). The companies such as Facebook and Google have been at the forefront of this data-driven development when they use predictive analytics, programmatic advertising, native advertising, content personalization, and so on (Bilić & Primorac, 2018). Therefore, the issues related to programmatic advertising as a pathway in digital transformation in the advertisement carry high importance because advertising can make more efficient transactions by using an automation advertising technology platform.

In addition, there are some studies that found in the conceptual background based on programmatic advertising in different areas. However, these studies could not describe the detail of what the role of programmatic advertising operation is; hence, this study analyses deeper about programmatic advertising to answer the following research questions:

*RQ1: What is programmatic advertising? How does programmatic advertising differentiate from traditional advertising?*

*RQ2: What are the opportunities and challenges of programmatic advertising applying?*

Therefore, this article is to analyse the background concepts and previous studies that relate to programmatic advertising in the advertising field. The rest of article is organized as follows: the second chapter reviews the concepts including the advertisement, digital transformation, artificial intelligence, big data, programmatic advertising, and previous studies that are based on programmatic advertising; the third chapter points out the research methodology of the study; the fourth chapter analyses the objective and function of programmatic advertising, and differences between programmatic advertising and traditional advertising; the fifth chapter focuses on the opportunities and challenges of programmatic advertising applying; the sixth chapter discusses the practical meaning and prospect of the research direction; the last chapter concludes the study.

## **2 THEORETICAL BACKGROUND**

### **Conceptual background**

Advertisement belongs to the creative service sector in creative industry (UNCTAD, 2008), and it is a business phenomenon that is considered as an investment of the advertiser following the companies' budget means the financial investment; for instance, the advertised cost is used for the hope of a future return (Ohlsson & Facht, 2017).

Digital transformation can be understood by using the digital technology to improve the organization's performance (Lindberg & Hemvik, 2015); and it is an organizational transformation that is affected by technology platforms such as data analytics, cloud, mobile, and social media platforms (Nwankpa & Roumani, 2016).

Artificial intelligence is considered as the programs, algorithms, systems, or machines that advance the intelligence of a product, service, or solution (Shankar, 2018) following the trend of digital technology, which is provided by the intelligent automated diagnostic, or management tools (Bhavaraju, 2018).

Big data is the large volumes of data, that generate and make available online in digital media ecosystems, can be generated and collected by different types of sources such as the daily activities of multiple transactions perform, and post on the social media; moreover, the artificial intelligence is used for big data to deploy the automatic processes, transformable companies, and creating new types of business (Pappas et al., 2018). Especially, the study of Trabucchi, Buganza and Pellizzoni (2017) points out in the case study based on big data and analytics through leverage of two-sided structure in advertising, this enables companies to capture the value from user-source data and a sustainable free-to-consumers business model which does not only focus on the targeted advertising but also data providers, and then the companies are going to capture the value that uses data for customizing advertising messages.

Programmatic advertising is referred by the buying and selling programmatic of digital advertising inventory, and it is used in advertising display, mostly for banner ads display such as static and rich media banners, and online video ads, on the fixed and mobile web. Besides,

the right message, the right audience, and the right time are displayed by advertising display, as well as the automation of ad buying, and real-time bidding helps advertisers to target the right audience with the collected data that uses and stores on each user. Especially, it is the automated buying and selling mechanism for online advertising display and driven by technology, such as the purchase and selling process pass through machine-to-machine automation instead of involving human input in the transaction (Grece, 2016).

### **Previously related studies**

Many previous studies relate to real-time advertising; for instance, the study of Stange and Funk (2014) show that the quality of available advertising space increasingly improves to use for branding campaigns; especially, data management platform (DMP) becomes more important through the automated decisions to rely on high-quality data. Moreover, Slater, Broyles and Clifton (2015) refer to the programmatic and real-time bidding which are programmatic media buying use algorithms to automate buying, placement, and optimization of ads. Realtime bidding has caused the change of impression way is not only the plan, buy and sell, but also advertising inventory that is sold via real-time bidding in an immediate auction on a per-impression. Also, González and Mochón (2016) analyse how new technological developments and the possibilities are generated by the internet that shapes the online advertising market in their study, the research has focused on a programmatic advertising case study by using a programmatic online advertising sale platform based on the big data tool and artificial intelligence platform to perform automatically, provide information in a user-friendly and simpler manner. Furthermore, the research of Martínez-Martínez, Aguado and Boeykens (2017) carried out the empirical study in Spain, that relates to the use of programmatic buying technology on a daily activity through the qualitative research using a panel of experts, and the study result identifies a major contradiction between professionals' views and users' perceptions based on using these tools. Another the study of Bilić and Primorac (2018) conducted in the online news industry in Croatia, which relates to the digital advertising gap based on the difference between the size of the internet advertising market and the total income of digital news' firms; the study findings point out an example of a market failure which does not efficiently allocate public information goods, and it concludes that there is significant influence between the capture of internet advertising investments and the capacity of news industries to produce public goods, such as the impact of digital intermediaries' advertising including Google's and Facebook's business model has reflected on contemporary society and the digital news industry in Croatia. Similarly, the study of Perlado Lamo de Espinosa, Papí-Gálvez and Bergaz-Portolés (2019) explored the changes that were created by the management of the media planner with the digital society, and their empirical study based on the triangular research including quantitative and qualitative methods that were joined by 140 media planners, and 5 agency expert interviews. The result of the study contributes to the understanding of the disruptive processes of digital transformation, as well as identifies the main changes produced in media planning by the impact of digital media.

## **3 METHODOLOGY**

To achieve the major goal of the study, this study focuses on the approach which involves analysis and review of the integrative literature, that is a form of research including review, critique, and synthesis of related literature following a generated integrative topic with the new framework and perspective (Torraco, 2005).

Moreover, the data of the study was collected by searching keywords including digital transformation, advertisement, programmatic advertising, big data, artificial intelligence, and creative industry from online databases such as Google Scholar and Proquest. As a result of

articles in the reference were found, and they were used to make a comprehensive list of literature for review. Research papers were entirely read and retained seventeen articles that are in line with the topic of study, as well as the specific findings related to the research questions were analysed and interpreted in this study.

Especially, the integrative review of this study uses a research process of Cooper (1982) including five stages: (1) problem formulation; (2) data collection; (3) evaluation of data points; (4) data analysis and interpretation; and (5) presentation of results. They are appropriately modified and applied in the study, as follows: (1) Conceptual phase comprises an introduction part in chapter 1, theoretical background in chapter 2, and research methodology in chapter 3; (2) Empirical phase is data search, evaluation, and extraction; (3) Interpretive phase is an analysis of programmatic advertising in chapter 4, opportunities and challenges of programmatic advertising applying in chapter 5, discussion in chapter 6, and conclusion in chapter 7; (4) Presentation phase is a display of research report and paper for publication.

#### **4 ANALYSIS OF PROGRAMMATIC ADVERTISING**

Programmatic advertising is an automation technology that buys and sells advertising in modern marketing. To research more the role of programmatic advertising application, this section studies its objective and function, and analyses the difference between traditional advertising and programmatic advertising, as follows:

##### **Objective and function of programmatic advertising**

Programmatic advertising, which is the advertising business, is developed by buying and selling processes between parties via automation software including systems are Ad Network, Ad Exchange, DSP, and SSP; it manages the automation of ad trading such as segmentation, profiling, inventory, as well as using the effective data for pre-campaign planning and post-campaign analysis for optimizing. Especially, two different techniques in programmatic advertising are direct programmatic and real-time bidding (RTB) that belong to the concept of programmatic trading (or buying). RTB is perhaps widely known in programmatic advertising with the selling advertising space through auctioning in real-time, the advertising space is won by the highest bid and the specific advert for user-leveraging with the personal information is collected by cookies and other tracking tools (Martínez-Martínez, Aguado & Boeykens, 2017). However, the programmatic ad buying and selling can also take the form of a direct purchase with fixed prices, which call direct programmatic, is known in advance between publishers and advertisers (Grece, 2016).

##### **How does programmatic advertising differentiate from traditional advertising?**

In traditional advertising, buying and selling advertising are done so simple such as advertisers or agencies who want to buy ads directly contact publishers, which is called direct buying, it leads to a cumbersome and time-process consuming, and the process also requires negotiations such as telephone conversations, e-mails, fax, and face-to-face (Grece, 2016).

Supposing that there is an example of publishers' website, what happens if advertisers have an advertising campaign using direct buying that runs ads on more publishers, besides, each publisher has many categories inside and each category has a lot of specialized pages in which have many banners; as well as advertisers want to buy the same inventory or how the empty inventories are, and so on. For advertisers, they want to buy ads in the most convenient, easy, and cost-effective, but publishers also want to maximize their inventories and profit. With this situation, the direct buying method is not a good solution for parties because it needs to have many human costs to realize and satisfy them. Consequently, Ad Network appears to help

publishers who effectively manage inventory, and advertisers can choose where their ads and bid auctions when buying the same as inventory, and so on; on the contrary, Ad Network is not still solved the problem of inventory redundancy for publishers, there is still a conflict of buying the same as inventory if a publisher belongs to many Ad Networks, etc. That is a reason for Ad Exchange appearance, it also helps publishers who decrease inventory redundancy and maximize selling price; similarly, it makes an advantage for advertisers to buy inventory from many different Ad Networks and publishers, as well as targeting the right customer with data-driven, price, and cost; however, the problem that Ad Exchange faces is inventory redundancy with the quality is so poor, so advertisers do not want to bid the high price for these inventories.

From the above-discussed example, it showed that both advertising buyer and advertising seller have different targets; advertising buyer always thinks how to buy ads in the most convenient with the best cost and reaching the right audience, while the advertising seller also considers how to sell ads with the best and fastest price that are suitable for the buyer. Moreover, although Ad Network and Ad Exchange help to eliminate the interference of humans in advertising trading, the optimized ads problem that runs more effectively with lower costs is not still controlled, and they still need to be contributed by a human. To solve this issue, DSP (demand-side platform) helps advertisers and agencies who can buy ads more effectively, but SSP (supply-side platform) also helps publishers who can sell ads with the best price; furthermore, both DSP and SSP reject the intervention of human.

To sum up, the analysed example pointed out a basic problem of the difference between traditional advertising using a direct buying approach and digital advertising with interconnected systems such as Ad Network, Ad Exchange, DSP, and SSP. However, how programmatic advertising actually operates is still a big question, and the next analysis clarifies the programmatic advertising operation process, as follows: When the specific webpage is connected by a user, there is an information exchange that takes place between servers about both user-profiles and ad space availability. The Ad Server connects to an SSP, which is a platform, controls the publisher’s ad inventory if the advertising space is not reserved; then the space availability is sent by SSP to an Ad Exchange platform that is the same as the ad market place with potentially interested buyers and different categories of products. At the same time, the Ad Exchange platform considers a place in which it operates as a meeting point for other platforms such as DSP, Ad Network, or other Ad Exchange platforms, and the information in regards to the user, more buyers or more inventories that are supplied by these platforms help to enrich the bidding process. Eventually, the winning DSP sends the information to Ad Exchange which continues to send it to SSP, placing the ad to reach the user’s eyes in the right place, and the right time (Martínez-Martínez, Aguado & Boeykens, 2017).

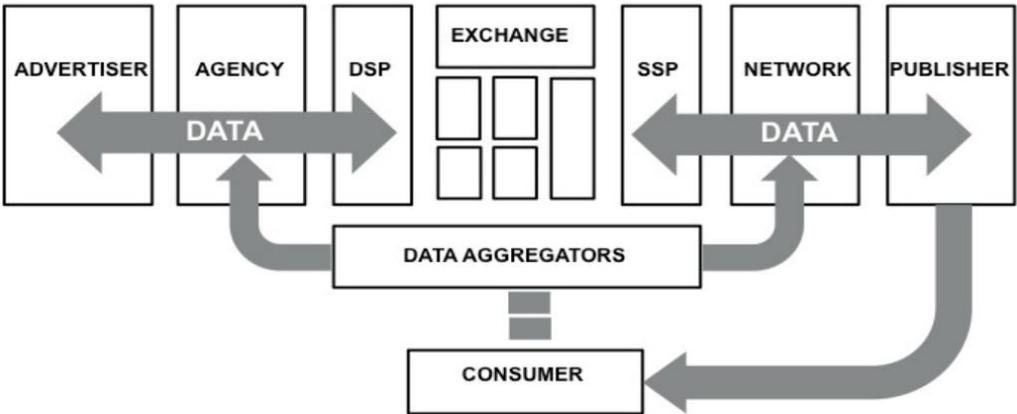


Fig. 1 – The programmatic advertising ecosystem. Source: Martínez-Martínez, Aguado & Boeykens (2017)

The figure 1, the study of Martínez-Martínez, Aguado and Boeykens (2017) illustrates that the programmatic advertising ecosystem with the data of user profile and behaviour are main input on both sides of the exchange with the emergence of data aggregators, that is called as DMP (data management platform), consider as third-party players underline the importance of user data to the very efficiency of the system. Especially, the data in programmatic advertising is classified by three categories depending on the origin of data (Grece, 2016), as follows:

First-party data is collected by publishers and advertisers, and it mainly comes from pixels of place on the website which is used for retargeting or remarketing to previous visitors. Also, data may gather from customer relationship management provided by the customer, cross-platform traffic, logged-in user data, and audience data from associated social channels and networks.

Second-party data is also collected by the share of first-party data through a partnership between players who are publishers and advertisers, or directly through DMP (shown in figure 2).



Fig. 2 – Data management platform. Source: Grece (2016)

Third-party data is collected by a third-party that supplies knowledge for a buyer relates to individual users, and data is stored by a DMP (shown in figure 2) or plug-in of larger demand and supply-side platforms.

Furthermore, there are two important techniques mentioned above in programmatic advertising, which are direct programmatic and real-time bidding (Martínez-Martínez, Aguado & Boeykens, 2017). According to Grece (2016), the real-time bidding, which is called by the auction-based sale of each ad impression, allows advertisers to bid on the value of each visitor to show their advertisements, and they are interested of the profile of different visitors including data gathered on the profile, interest, data on behaviour, location, and demographics. It is an advantage for advertisers to reduce costs because an advertisement is only shown when the profile is interested in the advertising under the condition that the advertiser wins the auction.

Contrary to the case of RTB, programmatic advertising also involves fixed prices, that are agreed upon between the publisher and advertiser, are called by programmatic direct (or automated guaranteed). There are four types of programmatic transactions such as automated guaranteed, unreserved fixed-rate, invitation-only auction, and open auction; The ad is placed on a reserved ad space, where the ad buyer will be placed on the publisher’s website, and unreserved fixed-rate (or preferred deals), means the ad buyer may not know a place where or when the ad is placed on a publisher’s website (shown in table 1 for more details).

For the invitation-only auction, it is the same as an open auction except for a publisher who is restricted participation to select buyers or advertisers via whitelist or blacklist; thus, a publisher

may not choose to participate in the open auction and only run in the invitation-only auction, that means is an auction, and buyers will be expected to bid on inventory.

Tab. 1 – The four types of programmatic transactions. Source: Grece (2016)

	Type of inventory	Pricing	Participation	Other Terms used
<b>Automated Guaranteed</b>	Reserved	Fixed	One-One	Programmatic guaranteed Programmatic Premium Programmatic Direct Programmatic Reserved
<b>Unreserved Fixed Rate</b>	Unreserved	Fixed	One-One	Preferred deals Private Access First right of refusal
<b>Invitation-Only Auction</b>	Unreserved	Auction	One-Few	Private Marketplace Private Auction Closed Auction Private Access
<b>Open Auction</b>	Unreserved	Auction	One-All	Real-Time bidding (RTB) Open Exchange Open Marketplace

Also, for open auction, all buyers are permitted to participate in accessing the publisher’s inventory that not relate to the buyer. This method allows publishers to choose to blocklists and floor pricing to prevent advertisers from gaining access.

On the advertiser’s side, they may not know what publisher they are buying on DSP, in which it only shows a list of exchanges or SSPs to the buyer who automatically joins. The buyers do not need to know or care what publisher’s inventory they are buying.

## 5 OPPORTUNITIES AND CHALLENGES OF PROGRAMMATIC ADVERTISING APPLYING

### Opportunities

Digital transformation provides many opportunities to fill the advertising spaces compared to traditional sales channels, as well as attracting advertising from outside of their own sales area. For the advertising buyer, programmatic trading may offer new opportunities to isolate and address the target groups that they are interested in reaching; similarly, it is not necessary to devote time and resources for contacting and negotiating with individual media companies. Particularly, the transaction cost of advertising distribution is reduced by the new technology, and the opportunity of private companies can create a sustainable business model online (Ohlsson & Facht, 2017).

Moreover, the programmatic television advertising also brings many benefits for digital programmatic transactions to the television advertising ecosystem reaching audiences across devices such as mobile, desktop, television, and better targeting; It also increase sales when using the advanced audience data which allows their advertisers to better target viewers, selling unsold inventory, and reducing the costs in regards to the ad selling process through automation (Grece, 2016). Especially, data is easy to collect, and it can understand consumers better through their behaviours so that the computer programs may buy ads within shows (e.g Hulu entertainment) that the individual watching what the programs are; for instance, time magazine is creating personalized print ads following personalized ads on customer’s phone or television (Slater, Broyles & Clifton, 2015).

## Challenges

The success of an advertising campaign or return on investment must depend on the measurement, analytics, and tracking of the performance of ads. This makes sure the ad is rightly delivered and viewed to avoid the ad fraud through false traffic; for instance, robots and the control of the environment, where the ad is delivered for brand safety reasons (Grece, 2016). Especially, the advertisement also faces the challenges of overcoming the advertising market control of Google and Facebook, as well as facing internet user habits of accessing free content, these are problems related to the digital advertising gap between rising the internet advertising market and the unsustainable income streams of digital firms (Bilić & Primorac, 2018).

Furthermore, many experts in the advertisement field think the businesses, existing advertisers, or money can be lost by the new method, as well as fear of innovation; this will be repeated along with a reluctance to change. Besides, the worry about the ethical aspects of the managed processes and data trading, and the users' level of information relates to the automated and highly specialized nature of data exploitation in programmatic advertising (Martínez-Martínez, Aguado & Boeykens, 2017). In addition, the programmatic television advertising will become more competitive in light of the challenge with the digital ad ecosystem because it dramatically increases the use of viewer data of connected and smart TVs, and the automation of ad inventory and buying process (Grece, 2016).

## 6 DISCUSSION

Programmatic advertising is an essential part of digital marketing, which is also the background of marketing online, for instance, Google, Facebook, and so on. However, it is not easy for researchers and practitioners to clearly understand programmatic advertising because understanding is still limited and misunderstood.

The implication of the study shows that the significance of programmatic advertising is in the development trend of the advertising field through the digital transformation by applying digital technology, such as big data, AI, and so on. Research questions in the study are answered by clarifying the objective and function of programmatic advertising and distinguishing the difference between programmatic advertising and traditional advertising, as well as determining the opportunities and challenges of programmatic advertising applying. In fact, the ad buying and selling can be conducted by human interactions in traditional advertising, but the programmatic advertising process through automated systems, such as Ad Network, Ad Exchange, SSP, and DSP, which eliminate the human interference of ad buying and selling between parties including advertisers, agencies, and publishers. Especially, there are two most important techniques in programmatic advertising, which are direct programmatic and real-time bidding in programmatic trading, are analysed in more detail of the study.

The limitation of this study is not possible to consider the whole of problems related to digital transformation in an advertisement; it only analyses and reviews the programmatic advertising from the conceptual background and the previous empirical studies to point out the difference between programmatic advertising and traditional advertising, as well as the opportunities and challenges facing a digital transformation in the advertisement.

In the future of study, it is necessary to have many empirical studies from challenges for the future growth of programmatic advertising including the impact of ad blocking tools, brand safety, and the limited visibility of commercial advertising campaigns, and so on.

## 7 CONCLUSION

The article studies the overall issues related to the trend of technology 4.0 along with the background conceptual including the advertisement, digital transformation, big data, artificial intelligence, and programmatic advertising, as well as the previous studies. Particularly, the problem applies the new technology based on the trend of technology 4.0 for digital transformation from traditional advertising to digital advertising, which helps researchers and practitioners can clearly understand the benefits of digital transformation in an advertisement which is programmatic advertising.

Moreover, if all companies in the advertisement would like to achieve the efficiency, quality, and flexibility for advertisement business success, they need to identify the opportunities and challenges in the application of new technology to carry out digital transformation in advertisement field; thereby, contributing to take advantage of opportunities and avoid risks for advertisement business.

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# LABOUR FORCE PARTICIPATION OF MARRIED WOMAN IN RUSSIA

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## **Abstract**

Women make up a little over half the world's population, but their contribution to the labour force is far below its potential, with serious macroeconomic consequences. Despite a recent progress, labour markets across the globe remain divided along gender lines, and female LFP remains lower than the participation of their male counterparts. This paper assesses the determinants of labour force participation of married woman in Russia, using data obtained from Russian Longitudinal Monitoring Survey (RLMS). The study employs two-step Heckman selection model whose major function is to give unbiased estimators of the parameters of the wage function, which could serve to estimate parameters of a structural equation of participation. Two types of proxies (the presence of children and household income characteristics) that affect the married female's opportunity cost of working but do not generate sample selection mechanisms are used in order to overcome the identification problem in the first-stage wage equation. The estimated semi-elasticity of married female participation to wage is equal to 0.24. The findings of the study also indicate that such factors as gender, age, the presence of dependent children, educational attainment, location and the religious affiliation are the significant determinants of the LFP. The income of the other household members, and race of the respondent, on the other hand, proved to be insignificant determinants of labour supply. As a result, the empirical evidence provided by this project can be useful in future assessments of current social security and employment policies implemented in transition economies.

*Keywords: economic transition, labour supply, female, labour market, Russia*

## **1 INTRODUCTION**

For more than half a century, labour markets across the globe have been witnessing increasing levels of female participation in employment. There are a number of factors that seem to be responsible for such historical trend, among which are male labour force shortages during and after the World War II, changes in social organizations facilitating and encouraging female employment (Mahoney, 1961), technological advances, alleviation of the household facilities, and changing social and employer attitudes towards working females (McGrattan & Rogerson, 2004).

At the same time, married females still remain one of the most vulnerable groups of employees, as their attitude towards employment lacks independence and more than often heavily depends upon such factors as income of a spouse, numbers of dependent children, and access to social security programs to name a few. The vulnerability of married females as a working class becomes more vivid in developing and transition economies, where low rates of married female labour participation are usually associated with limited access to healthcare programs and lack of appropriate childcare facilities. On the other hand, the necessity of having two earners during the turbulent transition period may act as a pressure stronger than the difficulties represented by the deterioration of childcare facilities (Bardasi & Monfardini, 2009). Since married females occupy a relatively large share of female labour force, the study of the determinants of married female labour force participation rates becomes essential.

To the best of authors knowledge, the literature analysing the LFP of married females in Russia is absent up to this date. This paper provides empirical evidence on Russian female labour supply behaviour and contributes to the pool of scarce literature on female labour supply in transition economies by analysing Russian Longitudinal Monitoring Survey (RLMS). In recent years RLMS is administered by Higher School of Economics, and the full abbreviation is thus RLMS-HSE.

Russia went through a number of political and economic transformations since the collapse of the Soviet Union in 1990-1991. A period of stagnation (1992-1998) was followed by a decade of rapid economic growth in 1998. This economic development resulted in increase in the living standards from 60-65% of that of Western Europe in 1990 to 70-75% by the 2010 (Novokmet, Piketty & Zucman, 2018).

However, since then there was only sluggish growth and the economy went into recession following financial crisis of 2008-2009, and the economic sanctions imposed by a number of countries (USA, EU, Canada, Japan, and some other countries) due to Russia's annexation of Crimea in March of 2014 and its reported involvement in Ukrainian conflict since then (European Union, 2019).

Currently the economy of Russia is trying to cope with the consequences of the sanctions and lower oil prices, as crude oil, petroleum products and natural gas compose nearly 60% of total exports (Halley, 2015). The heavy reliance of Russia on the commodity market for growth in a time of a global economic and political turmoil is clearly not a positive factor in the current economic situation of the country.

Furthermore, the situation of women in Russia is also a matter of concern. There is still no definition of discrimination against women in Russian constitution (Kosterina, 2011). The list of occupations where it is prohibited to hire a woman consists of more than 450 entries, and there is no guarantee of equal opportunities (in terms of equal pay or advance to higher positions) for men and women even in the case of successful employment (Kosterina, 2011).

Some recent studies show that the gender pay gap in Russia can reach up to 35-40% (Novikova, 2011), women more often than men are denied a loan by banks, and face daily sexual harassment at work (Obrazkova, 2015).

All of the above indicates that in Russia women face an environment close or similar to one faced by women in a typical developing country, and the empirical evidence provided by this project can be useful in future assessments of current social security, and employment policies implemented in transition and developing economies.

We choose to study the period just after the financial crisis, and before the imposition of economic sanctions on Russia in 2014. This particular period was chosen to minimize any unambiguity of estimations that may result from the effect of these two economic shocks on the Russian female labour market.

The research paper proceeds as follows: the second chapter reviews the existing literature on LFP of married female. The next chapter describes the data, descriptive statistics of the sample and implemented empirical methodology. The proceeding chapter presents the results of the estimations. The last section concludes the undertaken study, offers policy recommendations, and discusses possible limitations of the current paper.

## **2 THEORETICAL BACKGROUND**

Numerous studies have attempted to analyse the underlying factors determining the participation of married females in employment. Labour supply literature studying married

females' behaviour in the labour markets is vast and covers a wide range of countries (mostly developed) implementing different models to measure the impact of numerous factors on female labour force participation (LFP) rates.

In general, married female's decision to be employed is found to be inversely related to such factors as husband's income, non-labour income, and household wealth. These factors generally represent negative effect which induces married females to work less and consume more leisure. For instance, early studies indicate that negative income effect arises as a result of the increases in total income incorporated by the aforementioned factors, thus leading to an increase in purchasing power of various goods, including leisure (Eckstein & Lifshitz, 2011; Mincer, 1962).

The presence of dependent children and expectations of future life cycle events (such as a birth of a child, child's enrolment to school, or death of a spouse) also tend to influence the decision to participate negatively. This can be explained by the increased opportunity cost of working with the presence of dependent children within the household, increasing the reservation wage of the wife above the market wage (Eckstein & Lifshitz, 2011; Mincer, 1962; Cain & Watts, 1970; Spencer, 1973; Heckman, 1974, 1979; Shapiro & Shaw, 1983; Fosu, 1990).

In contrast, such factors as increase in a real wage, extensive experience, and education encourage married females to be employed. This pinpoints on mostly positive substitution effect, which increases the opportunity cost of leisure as a result of the increases in the level of earnings. The level of earnings, in its own turn, may be dependent on the investments into education and experience. Therefore, increases in real wages make leisure more expensive and induce females to the employment (Eckstein & Lifshitz, 2011; Mincer, 1962; Cain & Watts, 1970; Spencer, 1973, Heckman, 1974, 1979; Shapiro & Shaw, 1983; Fosu, 1990).

The magnitudes and signs of income and substitution effects may vary depending on the question at hand and time period considered. For instance, Shapiro and Shaw (1983) show that the responsiveness of married females' participation rates to husband's income (income effect) of white married-women aged 30-34 has declined slightly over the period of 1967-1978. On the contrary, authors observe that the elasticity with respect to the market wage (substitution effect) has in fact increased considerably over the same period. In order to explain the observed trend in LFP of married-women Brown (1985) proposes an alternative "institutional model" postulating that the wives' decision to work (in developed countries) reflects social norms rather than any substitution between home and labour market production activities.

Paying attention to the time horizon, Fosu (1990) estimates the relationship between LFP of married females and similar variables employed in previous studies. This relationship was compared to the previous estimates and the downward trend in the sensitivity of the LFP of married women to traditional economic variables proved to continue, however, the estimated impact of husband's income is found to substantially exceed those obtained by the previous studies. Hyslop (1999) goes further and analyses the intertemporal LFP behaviour of married women. The study concludes that married females' participation response is stronger to permanent rather than current non-labour income, reflecting unobserved taste characteristics of wives.

Apart from traditional variables, a number of factors have been found to explain labour supply behaviour of married females. For instance, the evidence suggests that the existence and extent of family borrowing restrictions positively affect married females LFP rates (Shack-Marquez & Wascher, 1987; O'Brien & Hawley, 1988).

Considering household characteristics, the size of the family proved to be one of the major forces influencing married females' LFP rates. Specifically, Mahoney (1961) finds that the size

of the family is inversely related to participation in the younger age and positively to participation in the older age groups. Generally, this can be explained by reasons such that after marriage women often have to migrate from one place to another; more time is required for childcare and home management as well as the fact that in so called “patrilineal paradigm” (especially in Muslim families) married women have to depend upon the approval of their husband even to re-enter the labour force after marriage (Khan & Khan, 2009).

Paying attention to the impact of public policy, married females’ decision to participate is found to exhibit the largest response to income taxation in comparison to other cohorts (Blundell, 1995; Blundell, Duncan & Meghir, 1998). This is particularly an issue for females that would like to work part-time, as they face relatively higher fixed costs of working (Cogan, 1981). Furthermore, the feedback from the public benefit system such as unemployment and childcare benefits should also be considered, as the benefit income of an unemployed man will be reduced if his wife works, imposing a ‘tax’ on the income of the married women (Kell & Wright, 1990).

On individual characteristics side, ethnicity (and/or cultural differences) is also found to influence the decision of married females to participate in labour. As Reimers (1985) shows the LFP of married females of different ethnicities (foreign-born whites, US born and foreign-born Hispanic, US and foreign-born Asians) differs compared to US born whites, even when comparing the married females with the same characteristics. Lee (1997) comes to the similar conclusions while studying the Korean labour market during the initial phase of 1970s industrialization. The study finds that while industrialization created a new job opportunities, the domestic ideology formed by “Confucianism” prevailed and influenced the LFP of Korean women inversely.

Kalb (2002) indicates that married women who are in their thirties and with a higher education have a higher prevalence for participation in a labour force. Moreover, Grossbard and Amuedo-Dorantes (2005) found that an increase in the growth rate of the sex ratio (the ratio of males to females in a population) results in a decline in the labour force participation growth rate of married women.

Boheim and Taylor (2005) conclude that about 40% of women prefer to work fewer hours at their current hourly wage, what indicates that working hours cannot be freely chosen by employees, (what is inconsistent with standard theory of labour supply) and are fixed by employer preferences or institutional factors.

Finally, Fosu (1999) examines the impact of cost of living on married females’ LFP in urban labour markets. The study argues that while the cost of living might serve as a pure price variable and influence the LFP of wives positively, it is also likely to reflect differences in the quality of living across localities, which may be translated into differentials in LFP.

In contrast to the developed economies, empirical evidence on married females’ labour supply behaviour in developing and transition economies is rather limited. Bhalotra and Umaña-Aponte (2010) study married females’ LFP rates in developing countries. The study finds positive income effect, reflecting discouraging effect of non-labour income on married females’ employment; although, the magnitude of income elasticity is found to be substantially lower. This result is explained by higher income volatility and limited access for such formal insurance mechanisms as unemployment benefits in developing economies.

Warunsiri and McNown (2010) investigate both intensive and extensive margins of labour supply of Thai women using synthetic cohort data constructed from the annual Thai Labour Force Survey (1985-2004). Their findings indicate that there is negative relation between wages and hours worked for Thai women suggesting the dominance of the income effect over the substitution effect. The authors also state that hours worked by married females are less

responsive to wage changes compared to their unmarried counterparts, however, the probability of working is more responsive in case of wives.

Tandrayen-Ragoobur, Ummersingh and Bundhoo (2011) analyse factors influencing the Mauritian females' decision to enter the labour market. Using household survey data for 2006-2008, the study finds that higher educational attainment encourages women to enter the labour market. Moreover, the analysis shows that marital status has a strong negative impact on woman's decision to enter the labour market, which is explained by the lack of facilities in terms of day care centres for children and lack of flexible working hours.

The post-Soviet Union countries in general found to be less elastic to various economic variables affecting labour supply of wives, and focus mainly on the analysis at the extensive margin (Chase, 1995; Paci & Reilly, 2004; Bicakova, Slacalek & Slavik, 2008; Pastore & Verashchagina, 2004, 2008). The former can be justified by the fact that during the communist regime social planners implemented social policies that aimed to provide all citizens with work (Bauerova, 1987), and thus those countries may have inherited the inertia of two workers per household, that was promoted during the regime (Paukert, 1991). The justification for the latter is the fact of the presence of labour agreements and incompleteness of the data sources, which would not allow focusing on intensive margin (optimal hours of work).

Chase (1995) studies the LFP of married females in Czech Republic and Slovakia, after the collapse of Communist regime. The study concludes that the LFP have decreased in both regions, and particularly for young wives. While the wage elasticity increased in Slovakia, it dropped in Czech Republic, suggesting that the set of options married females face has narrowed after the fall of Communist regime.

Siliverstovs and Koulikov (2003) estimate the hours of labour of married females in Estonia. The study finds positive wage elasticity whereas non-labour income's impact on labour hours is insignificant. The findings of this study are similar to the findings of Saget (1999), who finds positive wage elasticity in Hungary. Prior and similar to Siliverstovs and Koulikov (2003), Saget (1999) finds insignificant effect of non-labour income, suggesting that Hungarian women take their labour supply decisions independently of the earnings of the other household members. The analysis also indicates that female labour supply in transition economies is high and comparable to male economic activity in western countries.

An interesting study is provided by Bardasi and Monfardini (2009), who analyse the LFP behaviour of Polish women during four years before transition (1987-1990) and three years after (1994-1996). Empirical findings suggest that worsening of the childcare facilities discouraged married females to enter the labour market. However, the pressure put by low incomes and the need of a second earner in a household persuaded married females to work. As a result, the impact of budgetary restrictions outweighed the impact of deterioration in childcare facilities resulting in increasing LFP rates among Polish wives.

Moreover, the privatization of State-owned enterprise and a general weakening of employment protection legislation in a period of transition have increasing hard budget constraints for firms forcing hence the least motivated and skilled women from low wage employment into inactivity (Munich, Svejnar & Terrell, 2005). This would give the wrong impression of an increase in female wages and a reduction in the unexplained gender wage gap; in fact, women average wages in Belarus were declining when considering also those who had become unemployed or inactive. (Pastore & Verashchagina, 2004).

Clearly, empirical evidence of labour supply behaviour of married females in developing and transition economies is scarce. Moreover, to the best of author's knowledge the empirical work examining the LFP of this cohort in Russia has not been done yet. Therefore, the following

paper will attempt to fill this “gap” in the literature by examining the determinants of LFP of married females in Russia.

### 3 METHODOLOGY

#### Econometric Model

Until 1970’s most academic papers could not distinguish between choices at the intensive (hours of work, weeks) and extensive (the decision to participate) margins in a labour force. Thus, creating a problem of missing wages, which accounts for a self-selection bias in estimating wage and labour supply functions on samples of workers (Heckman & MaCurdy, 1982; Heckman, 1993). As a result, some early studies overestimated the wage elasticity of married female as participation elasticities for women were being compared with hours of work elasticities for men (Heckman, 1993).

The empirical methodology is based on a two-step selection model adopted from Heckman (1974, 1979) in order to approximate the wages of those women who do not participate in a labour force, and tackle selection bias problem arising from non-random sampling of the data. The study focuses on the analysis at the extensive margin, as the existence of labour agreements, which prevents the workers to choose freely the hours worked, and data limitations on transition economies would not allow us to study the intensive margin of labour supply (see, for instance, Saget 1999; Chase, 1995; Paci & Reilly, 2004; Bicakova, Slacalek & Slavik, 2008; Pastore & Verashchagina, 2008).

The structural participation equation could be expressed as follows:

$$Prob[p_i = 1] = f(Z_i, lnw_i, lnh_i) \quad where \quad i = 1, \dots, N \quad (1)$$

where  $p_i$  equals 1 if woman participates in the labour force and 0 otherwise.  $Z_i$  is a vector of the household, demographic, and regional variables that are assumed to influence LFP of married woman;  $w_i$  is the offered market wage to the  $i$ th individual in the formal labour market;  $h_i$  is a measure of household’s wealth characteristics such as total assets, non-labour personal income and total household income.

However, we cannot observe the wage variable for nonworking females, and the estimation based only on a sample of working women can lead to misleading results due to a biasedness of the selected sample (Heckman, 1974). The most straight forward solution would be to estimate the wage function on a sample of workers based on their individual characteristics, and deduce the wage for non-participants with the same characteristics (education, age, work experience, and others).

Assume that the wage equation can be expressed as follows:

$$lnw_i = g(X_i) \quad i = 1, \dots, N \quad where \quad M < N \quad (2)$$

where  $X_i$  is a vector of wage determining variables some of which overlap with those contained in  $Z_i$  vector. The problem arises as wages are observed only for  $M$  of the  $N$  number of women in the sample.

The early studies were using the above-mentioned procedure and thus estimating the wage of non-participants using the wage obtained by the sample of workers with the same characteristics ( $X_i$ ). However, this approach will lead to a sample-selection bias, since we assume that this wage equation (2) also applies to the notional wage of non-participants. This hypothesis is highly unlikely, as the participants in the labour market, on average, should have non-observed characteristics that allow them to demand higher wages. Thus, this estimation procedure will

consistently overestimate the notional wages of non-participants as a result of sample-selection bias (Heckman, 1974).

One solution to overcome this bias consists of simultaneous estimations of equations explaining wages and decision to supply labour. In order to accomplish this procedure, we will apply the two-step selection procedure adopted from Heckman (1974, 1979).

The first step (reduced selection equation) involves the estimation of the probability of woman being employed:

$$Prob[p_i = 1] = f(Z_i, ln h_i) \quad \text{where } i = 1, \dots, N \quad (3)$$

The estimates from this equation are then used to construct the Inverse Mills ratio for each of M women participating in the labour force. The Inverse Mills ratio is then inserted to the wage equation as an additional explanatory variable accounting for possible selection bias resulting from non-random selection of data (Heckman, 1974, 1979). The estimated coefficients of the wage equation can then be used to predict the hourly wages of all N individuals in our sample. Thus, the structural participation equation can be re-expressed as follows:

$$Prob[p_i = 1] = f(Z_i, ln \hat{w}_i, ln h_i) \quad \text{where } i = 1, \dots, N \quad (4)$$

where  $\hat{w}_i$  is the predicted wage offer for the  $i$ th individual.

This approach would allow us to eliminate the bias in wage equation fitted to the sample of workers. Thus, we can estimate our model by a standard probit model expressed by the cumulative (normal) distribution function.

$$Prob[y_i = 1|x_i] = \Phi(\mathbf{X}_i' \beta) + u_i \quad (5)$$

with a binary dependent variable  $y_i$  for LFP of married woman, which takes values of either one or zero ( $y_i = 1$  if the respondents reply that they have a job or unemployed and seeking for it; and  $y_i = 0$  for the inactive who are neither working, nor seeking for it).

Several points regarding Heckman (1974, 1979) two-step procedure need to be made. Firstly, the identification of the parameters in the wage equation is crucial to this study. The identification of the wage equation requires the variables (proxies) that affect the married female's opportunity cost of working but do not generate sample selection mechanisms (Saget, 1999; Siliverstovs & Koulikov, 2003; Pastore & Verashchagina, 2008). Secondly, the two-step procedure assumes that the unobserved characteristics (error terms) of the individuals in the reduced selection equation are normally distributed and correlated with error terms in the wage equation. The violation of any of these assumptions can lead to a misspecification of the model (Smutna & Scasny, 2017).

### **Identification of the Variables in the Two-Step Model**

Since some of the variables are not observed for the non-working individuals of the sample (occupation, work experience etc.), they should be excluded from the augmented wage and participation equations. Thus, three types of the individual characteristic variables such as age, level of educational attainment, and ethnicity were used. Moreover, a dummy variable representing Muslim married females is created, as the ideology of the husband being a main breadwinner may be stronger in these families (Khan & Khan, 2009).

As mentioned above, the first step equation (the probability of the woman being in the labour force) should include at least one additional variable that is not present in the wage equation. Such a proxy variable should influence the decision to participate and do not impact the offered

wage of the individual in order to avoid the potential problems in identifying the parameters in wage equation separately.

Two types of such variables were chosen (the presence of the dependent children and the household income characteristics) to overcome the identification problem. We thus assume that presence of the children of different age categories and household income characteristics do not influence the wife's wage offer but affect her labour force participation decision (Saget, 1999; Pastore & Verashchagina, 2004, 2008). In particular, the wife's personal non-labour income, total amount of assets owned by the household (capital), and other income of the household (total income of the household minus total income of the wife) were chosen to represent household income characteristics. The latter (other income of the household) was preferred to husband's income as similarly to the case of Hungary, outlined by Saget (1999), the "overlapping generations households" are also present in Russia.

Moreover, the regional variables were also included as they may impact both wage and labour participation decision of the married female. In order to consider the region-specific characteristics, we selected four regions. "Central" region includes the central part of the country including the capital, Moscow city. The northern part of the Russia is represented by "North Caucasus" and region namely "Northern" which includes all other northern parts of the country. Finally, in order to contrast the severe environment of North, the relatively warm region namely, "CentralBlackearth" with a soft environment was also selected.

### **Identification of the Variables in the Structural Equation of Participation**

The structural equation of participation contains almost all the variables that were included into the first stage reduced participation equation along with predicted log of wage obtained from the first stage of the two-step selection procedure. The variables included into the wage equation (age, educational attainment, ethnicity, urban location, and regional variables) are not included to the structural participation equation, as they are assumed to influence the participation through the wage offer, and including them can raise potential problems in identifying the parameters separately from wage.

### **Data**

The paper employs Russian Longitudinal Monitoring Survey data for the period in between the financial crisis of 2008-2009, and the imposition of economic sanctions on Russia in 2014. The primary reason for using the data for this period is that the economic shocks brought by these two events affected many sectors of the economy (Novokmet, Piketty & Zucman, 2018) and can potentially obscure the estimation results. Thus, we employ the survey that was conducted in 2011-2012 in 11 economic regions of Russia. The survey administered 7651 randomly selected households with 21993 individuals.

RLMS is administered by the Higher School of Economics, and the Carolina Population Centre at the University of Carolina. RLMS is a survey that examines the effects of Russian reforms on the health and economic welfare of households and individuals in the Russian Federation. It includes a wide set of questions on labour activity and family background characteristics.

The household and individual surveys were pooled together in order to obtain additional characteristic variables of individuals dependent on household structure and total income. In our study, we selected the sub-sample of the survey that contains 3341 married females aged 17-54 in both rural and urban areas who were either employed or unemployed during the time of the survey (See Appendix B for detailed description of the sample). In this subsample 2174 married women were actively participating in the labour force whereas remaining 1167 were unemployed.

More than a half of the respondents are located in the urban areas (66.35%). The average age is 37 years. More than a third of the surveyed married women have a higher education (almost 35%), almost a third has a technical secondary and another third have general secondary. Primary education was reported only by 0.14% of the sample, which is with consensus of generally high literacy rate of the population of the post-Soviet countries. The presence of the children aged from 1 to 3 years was reported by 27.5% of the married females. The children aged 4 to 8, and 9 to 13 years were ones with highest presence, 73% and 77.8% respectively. The children in the category of 14-17 years old were reported only by 16.7%.

As ethnicity can potentially impact the participation of the married woman and her wage offer it was also included into the estimations. In this particular case, the sample was divided to Russian and non-Russian respondents. The 14.2% of the respondents reported to consider themselves of a non-Russian ethnicity. Muslim married females account for (6.2%) of the total sample.

## **4 RESULTS**

Unlike in other studies of women LFP in transition countries (Saget, 1999; Siliverstovs & Koulikov, 2003), who found no selection bias in their datasets for Hungary and Estonia respectively, our estimations have detected the presence of sample selection bias for Russian dataset (the Inverse Mills ratio is statistically significant). Thus, estimating the LFP equation by probit without correcting for selection bias would lead to biased and inconsistent estimates.

### **Reduced Participation Equation**

On the first stage, the likelihood of being in the labour force is computed using different individual and household characteristics of the respondents (See appendix C for a detailed table). The effect of education is statistically significant for technical secondary and higher education. In accordance with the results, having higher and secondary technical education substantially increases the probability of married females to participate in the labour force.

Children in general have similar effects to those obtained in other studies (see the structural equation of participation). The presence of children aged 1 to 3 years influences the LFP rate of wife negatively. The impact of children of age categories of 4-8 years old, and 14-17 years old proved to be insignificant. The effect of children between 9-13 years old has a positive effect and is significant at 90-percent.

The effect of being of nationality other than Russian, and the size of the family are insignificant determinants of LFP. The religion (in this particular case, the dummy variable for the Muslim wives) on the other hand, has a significant and relatively strong negative impact on LFP of married female.

The variables representing household income characteristics, in general, are statistically insignificant. The effect of other income of the household (income of the husband and other members of the family) is highly insignificant, and in line with the findings by Saget (1999) who concludes that Hungarian women take their decision to supply labour independently from the income of their husbands or other members of the family. The impact of the capital is (total assets in the households) also insignificant. The only statistically significant income variable was non-labour personal income of the wife. This result shows that Russian wives rely, in general, on their own income rather than income of other family members.

The age profile proved to be statistically significant. The coefficient of age has a positive sign and shows that the woman is more probable to work as her age increases. However, this effect is only up to some point, after which the age starts to influence the probability negatively, as

suggested by its concave form. This result is in line with findings by Saget (1999), and Paci and Reilly (2004).

Finally, living in the urban area increases the LFP rates of married females. Looking at the regional breakdown, the results also suggest that married females residing in northern region of the country tend to participate in the labour force more actively. This may be explained by higher level of earnings in this particular region (see wage equation).

### **Wage Equation**

As the results reflect, the wages, in general, are not dependent on age profile of married female. In contrast, having higher education positively affects the wages being earned. That is, as the level of educational attainment increases, the wages of married females may expect to increase accordingly. Hence, married females with higher educational attainment, on average, receive 40-percent higher wages compared to those with lower educational attainment. This result is similar to other studies in transition economies (Paternostro & Sahn, 1998; Saget, 1999; Siliverstov & Koulikov, 2003).

Looking at ethnicity and regional location variables, we see that being non-Russian does not determine the size of the wages offered to the married females. On the other hand, married females located in urban areas, on average, earn 28-percent higher salaries compared to those in rural areas, supporting the findings made in similar studies on transition economies (Paternostro & Sahn, 1998; Siliverstovs & Koulikov, 2003; Paci & Reilly, 2004). Furthermore, those wives settled in “northern” and “central” areas of Russia on average earn 46-percent and 35-percent higher wages, respectively, as compared to married females in other regions. The effect of central region is in line with other studies (Siliverstovs & Koulikov, 2003) where the dummy variable for individuals living in the capital is estimated to have a positive impact on wages. The positive impact of “northern” region can be attributed to the unpleasant environment in this particular location of Russia. The impact is highly significant, indicating that workers should be compensated for the harsh weather conditions in these regions.

As the proposed explanation of the positive impact of the “northern” region comes from a conventional knowledge this hypothesis should be checked for validity. To check the validity of the hypothesis, one more region with relatively better environmental conditions is included to the wage equation. Then, if proposed hypothesis is correct, the region with relatively better conditions should influence the wages negatively. Indeed, estimations show that those married females settled in “centralblackearth” tend to receive on average 27-percent lower wages compared to individuals in other regions supporting the argument above.

### **Estimation of Structural Equation of Participation**

The consistent wage estimator obtained from the reduced participation and wage equations allowed us to derive the predicted wages for both working and non-working individuals in our dataset. We then estimate the marginal effects from the probit model using the predicted wage along with other control variables. Marginal effects of binary variables are calculated as a discrete change in the predicted probability, induced by the value of the variable changing from 0 to 1. In order to explore the fit of the model, two standard measures of probit model were used, namely pseudo R-squared and chi-square statistics of the Wald-test (see Appendix C).

The value of the pseudo R-squared is equal to 0.1674, the chi-square statistics of Wald-test of all coefficients (except intercept) is highly significant indicating a rather good fit of our model. The computed semi-elasticity of wage is equal to 0.24 at the 1-percent significance level. That implies that for every 1-percent increase in offered wage, the probability of LFP of married women will grow by 0.24-percent in Russian Federation. The computed semi-elasticity is

substantially smaller compared to those obtained in other similar studies on transition economies. For instance, Saget (1999) estimated the wage elasticity of Hungarian females to be 1.81, while Siliverstovs and Koulikov (2003) estimated the wage elasticity of married females for Estonian dataset to be 0.53.

Other marginal effects are almost similar to those obtained in reduced participation equation at the first stage. Other household income as well as capital (total assets) have statistically insignificant impact on wife's decision to work, similarly to Saget (1999) and Siliverstovs and Koulikov (2003), indicating that in transition economies married females take their decision to participate independently from the income of their husbands or other members of the family. Non-labour personal income, on the other hand, is highly significant, although, the marginal effect is very small (0.007), indicating that, generally, a 1-percent increase of non-labour personal income will decrease the probability of LFP by 0.007-percent.

The study finds that the size of the family does not affect the probability to participate in labour. However, the children under the school age (1-3 years) have a significant negative influence on the probability of wife's LFP. The presence of the children of this age category in the household decreases the probability to participate in a labour force by 41-percent. The effect of children aged 4-8 years is insignificant, whereas starting from 9 years children increase the probability of married woman to participate in the labour force by 5.8-percent.

The effect of children of younger age (1-3 age) is in accord with those obtained by Saget (1999), Siliverstovs, and Koulikov (2003), where the authors conclude that the presence of children of younger age categories affects the probability of wife being in the labour force negatively. The effect of children in the older age category (13 and older), on the other hand, contradicts to those obtained by Siliverstovs and Koulikov (2003), and in line with those obtained by Saget (1999). The former study concludes that in Estonia children of both younger and teen-age categories impact the LFP of married female negatively, whereas the latter study reports the positive effect of children of the teen age on labour supply decision. This can be explained by the availability of additional free time as the child gets older, and the financial constraints related to raising the children in the older age categories which also induces the woman to enter the labour force.

The effect of religion is statistically significant, and indicates that Muslim wives are less probable to participate in the labour force by 28-percent in Russia. We can attribute this to the ideology of man being the main bread-winner and the woman being a homemaker in those families (Khan & Khan, 2009).

## **5 DISCUSSION AND CONCLUSION**

The study arrives at a number of interesting conclusions. First of all, the semi-elasticity of wage of the married females in Russia is lower (0.24) compared to those reported in other similar studies on transition economies (Saget, 1999; Siliverstovs & Koulikov, 2003). This implies that a 1-percent increase in the wage rate leads to 0.24-percent increase in married female's participation rate.

The elasticity of the age proved to be concave, indicating that the labour supply of married female in Russia increases with her age, however, this effect is only to some point after which the age is a decreasing function of labour supply. These findings are in accord with the results obtained in transition and classical labour supply studies.

We also found that the non-labour income (income of the spouse and other members of the household) is insignificant determinant of labour supply of the married woman. These findings are in line with those obtained by Saget (1999) and Siliverstovs and Koulikov (2003), and in

contrast with the results obtained in other classical literature on female labour supply, where the negative impact of non-labour income is reported (Rosett, 1957; Mincer, 1962; Cain & Watts, 1970; Spencer, 1973, Heckman, 1974; Heckman, 1979).

The presence of dependent children (below school age) has a discouraging effect on labour supply of married woman, while the presence of children of school age motivates females to work. These findings are in line with those of Saget (1999), but partially contradict to Siliverstovs and Koulikov (2003) who find that the presence of children in both younger and older age categories have a negative impact on married females' decision to participate in labour.

The study also finds that Muslim females 28-percent less inclined to participate in labour market as compared to other religions in the study. This may be explained by the ideology of a man being a main breadwinner, and the wife being mostly a homemaker in this type of households (Khan & Khan, 2009).

The location of the individual is found to be an important determinant of the wage offer and the probability to participate in the labour force. Married females in urban areas are more likely to participate in labour and receive wages 28-percent higher as compared to rural areas. Moreover, married females residing in the central part of the Russia (including Moscow) are found to earn wages that exceed wages in rural areas by 35-percent. This can be attributed to the fact that in urban areas, and especially in the capital city, the cost of living is generally higher and the central areas are often the primary subject to economic reforms, which bring better and higher-paid jobs for the inhabitants (Siliverstovs & Koulikov, 2003). The effect of the "Northern" region on both offered wage and decision to participate is also rather conventional. The harsh environment of the north requires some additional monetary compensation for workers, which in turn increases the supply of labour in this region.

Finally, the profile of education seems to impact both the probability to participate in the labour force as well as the wage offer of married females. The findings are in line with conventional findings of other studies. Married females with higher education are more likely to be employed and in general tend to receive 40-percent higher wages, compared to those with lower educational attainment.

To conclude, we would like to outline limitations of this study, and propose some potential directions for future research. In particular, the current study did not consider possible empirical specification problems as endogeneity, as this is out of scope of the current study, and may serve as an avenue for the future research. Moreover, the future studies can implement a dynamic analysis of the LFP of this cohort as well as to study more factors that could potentially impact the labour supply decision of the married females in Russian Federation.

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## Appendix A: Definitions of the variables

**Age:** Age of the respondent in years.

**Education:** Educational background of the respondent; classified into primary, general secondary, technical secondary and higher.

**Children:** The presence of children in the household classified to four categories by age, namely: children (1-3 years), children (4-8 years), children (9-13 years), children (14-17 years).

**Family size:** The number of family members in the household.

**Capital:** The total amount of assets owned by the household in rubbles.

**Other household income:** The total household income minus the total income of the respondent

**Net wage:** The gross wage minus all explicit and implicit taxes.

**Non-labour personal income:** The total personal income of the respondent minus her wage.

**Urban:** A dummy variable taking value of 1 if the respondent lives in an urban settlement and 0 otherwise.

**North Caucasus:** A dummy variable taking value of 1 if the respondent is located in “North Caucasus” and 0 otherwise.

**Central:** A dummy variable taking value of 1 if the respondent is located in “Central” region of the Russia and 0 otherwise.

**Northern:** A dummy variable taking value of 1 if the respondent is located in “Northern” region of the Russia and 0 otherwise.

**Central Black Earth:** A dummy variable taking value of 1 if the respondent is located in “Central Black Earth” region of the Russia and 0 otherwise.

**Non-Russian:** A dummy variable taking value of 1 if the respondent reckons himself to of a nationality other than Russian and 0 otherwise.

**Muslim:** A dummy variable taking value of 1 if the respondent is Muslim and 0 otherwise.

## Appendix B: Descriptive Statistics

*Tab. 1 – Descriptive Statistics of dummy variables. Source: author’s estimations*

<b>Variable</b>	<b>Percent%</b>	<b>Observations</b>
Employed	66.92	3341
Higher Education	34.09	3341
Secondary Tech.	28.43	3341
Secondary	29.42	3341
Primary	0.14	3341
Urban	66.35	3341
Children 1-3	27.56	3341
Children 4-8	73.06	3341
Children 9-13	77.82	3341
Children 14-17	16.73	3341
Non-Russian	14.24	3341
Muslim	6.22	3341
Central	20.62	3341
North-Caucasus	14.33	3341
Northern	4.84	3341
Central Blackearth	5.95	3341

*Tab. 2 – Descriptive Statistics of continuous Variables. Source: author’s estimations*

<b>Variable</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Min</b>	<b>Max</b>
Age	37.393	9.524645	17	54
Age^2	1488.928	727.6642	289	2916
Other income	30606.74	44785.91	0	1750000
Nonlabor personal inc.	2217.912	6195.367	0	100000
Capital	12577.61	59591.9	0	1200000
Family size	3.810536	1.416442	1	13

## Appendix C: Results

Tab. 3 – Two-step Heckman selection. Source: author's estimations

Variable	Coefficient	Std. Err.
<b>Equation 1: logarithm of Net Wage</b>		
Age	0.017	0.014
AgeSq	0.000	0.230
Higher Education	0.398***	0.000
Technical Secondary	0.060	0.293
Primary	-0.606	0.308
Non-Russian	0.037	0.387
North Caucasus	0.058	0.163
Northern	0.463***	0.060
Central Black Earth	-0.270***	0.056
Central	0.355***	0.033
Urban	0.287***	0.030
Intercept	8.581***	0.281
<b>Equation 2: selection to employment</b>		
Age	0.103***	0.026
AgeSq	-0.001***	0.000
Higher Education	0.589***	0.100
Technical Secondary	0.351***	0.099
Primary	-0.329	0.737
Children 1-3 yrs	-1.073***	0.068
Children 4-8 yrs	-0.052	0.065
Children 9-13 yrs	0.113*	0.070
Children 14-18 yrs	0.039	0.077
Ln Other Income	0.010	0.418
Ln Capital	0.002	0.187
Ln Nonlaborpersonal inc.	-0.022***	0.000
Family Size	-0.003	0.023
Non-Russian	-0.119	0.090
Muslim	-0.613***	0.128
North Caucasus	-0.112	0.155
Northern	0.247**	0.127
Central	-0.006	0.066
Central Black Earth	-0.038	0.115
Intercept	-1.589***	0.473
Lambda	-0.1326133**	0.054
Rho	-0.5839775	
Sigma	0.6195080	
Wald chi2(12)	535.56	0.00

Tab. 4 – Structural Equation of Participation. Source: author's estimations

<b>Variable</b>	<b>Marg. Effect</b>	<b>Std. Error*</b>
<b>LnNet Wage</b>	0.240***	0.085
<b>Ln Other Income</b>	0.000	0.000
<b>Ln Capital</b>	0.000	0.111
<b>LnNonlaborpersonalInc.</b>	-0.007***	0.000
<b>Family size</b>	-0.010	0.022
<b>Children 3 yrs</b>	-0.416***	0.055
<b>Children 4-8 yrs</b>	-0.026	0.064
<b>Children 9-13 yrs</b>	0.058***	0.063
<b>Children 14-19 yrs</b>	0.033	0.073
<b>Muslim</b>	-0.288***	0.104
<b>N of observations</b>	3341	
<b>Log likelihood</b>	-1765.6165	
<b>LR chi2(10)</b>	709.84	
<b>Pseudo R2</b>	0.1674	

Note: \*, \*\*, \*\*\* are significance levels: 10%, 5%, 1% respectively.

\*Standard errors are bootstrapped, 500 replications

# THE ANALYSIS OF TOURISTS' TRAVELLING PREFERENCES

*Lukáš Vaľko, Eva Smolková*

## **Abstract**

The customer preferences are always an important factor, which businesses have to consider when creating an offer. These preferences are the basis, which plays a vital role in customers' purchasing decision-making process. The tourism sector is very specific and its customers – tourists – have very specific, and often unconventional, needs and wishes. This was also an idea behind this paper, whose main objective is to analyse the tourists' preferences regarding three activities related to tourism - purchasing of an accommodation, choosing the transportation method, and visiting the attractions/events in the destination. The data for an analysis were collected through the electronic questionnaire, where respondents should arrange several factors depending on how important they are when making a purchase decision about the above mentioned travel-related activities. The collected data were then analysed in MS Excel and IBM SPSS software to provide a relevant, mathematically verified results. We have successfully identified tourists' preferences by each of these activities and then we have researched the significance of selected demographical, geographical and economic factors influence on them. The influence was identified based on a Pearson Chi-Square test, which enabled us to define which factor should be considered when trying to attract a potential customer - tourist.

**Keywords:** *tourism, customer preferences, purchasing behaviour, accommodation, transportation, destination*

## **1 INTRODUCTION**

Tourism is a very specific economical sector, which we are not able to forecast with any guaranty. It develops extremely quickly, and this development is being positively or negatively affected by a high number of factors. These factors include, but are not limited to, for example, a global economic situation, a wealth of people, prices of strategic goods or the weather (Hudson & Hudson, 2017). These are just a few of many circumstances, which can easily change the development of all tourism activities and the whole sector 'from night to night'.

There are other factors, which can occur extremely quickly, and which no tourism organization can prepare for. The typical and very actual example is a health threat caused by a global pandemic of COVID-19 disease, which is also called coronavirus. This pandemic has caused a humongous fear, worries and resistance to almost all the travelling activities. Almost whole tourism sector has collapsed, most of the businesses operating in the sector were forced to shut their premises down, what caused not only huge financial losses for them, but for the global economy, too (UNWTO, 2020). However, we do believe, that current situation is just temporary and soon we will be able to get back to normal and restart the tourism sector.

The choice of the topic was intentional, as it is part of the main research of the authors. As tourists' purchasing behaviour and preferences are unique compared to different industries (Chen & Gursoy, 2001), it is important to research them, especially in this unpredictable time period. In Slovak conditions, similar studies are missing. Therefore, the authors decide to start an initial research to identify the changes of tourists' behaviour brought by the pandemic.

The aim of this paper is to analyse the tourists' preferences regarding three activities related to tourism - purchasing of an accommodation, purchasing of the travel services, and visiting the attractions/events in the destination.

## 2 THEORETICAL BACKGROUND

### 2.1 Tourism definition

Tourism is a group of persons, businesses, organizations and places which cooperates in a right manner to create the strongest possible customer experience. The result of such cooperation is a product (or service), which enables this experience (Cooper, 2008). The original reasons why people travel and enable these products to exist are relax, education, exploring and entertainment (Tribe, 2009). However, in a modern world there exist many more reasons and the new are always being defined. Such reasons are, e.g. mass events (religious, cultural or sport), exploring the new cultures, gastro-travelling, travelling for adventurous and adrenaline experiences or simply to learn and train a new language (Csikszentmihalyi, 2017). However, the established and worldwidely used definition is provided by UNWTO (World Tourism Organisation) and this definition is based on a term ‘visitor’. Visitor is such person or group of persons who travel to a destination other than their home address for less than a year for any reasons other than work or studies. Tourism is therefore defined as all the activities visitors do by planning and executing their trip (United Nations, 2010). As was mentioned, the number of reasons, why are people travelling is incalculable. The example from UK shows, why London visitors decided to visit the English capital.

Tab. 1 – Share of London visitors due to the reason of visit, 2015. Source: statista.com

Reason to visit London	Share of London visitors
Holiday	52%
Visiting friends and relatives	22%
Holiday - for a specific cultural or sporting event	8%
Educational or study visit	6%
Business trip	4%
Business trip for a specific conference/event	2%
Other	6%

### 2.2 Tourists and their purchasing behaviour

Customers in tourism, also called tourists, are different than customers in other sectors and they differ one from another as well. However, for managers in tourism it is important to identify them and to identify their preferences, needs and wishes (Cuculeski, Petrovska & Cuculeski, 2016). Also they are primarily a tourism object and they create a demand, in specific cases they create a supply as well. The best example is private accommodation – e.g. Airbnb.

The most important factors which tourism businesses have to consider when executing any marketing activity, is customers motivation and their purchasing behaviour (Hudson & Hudson, 2017). Consumer behaviour groups the reasons, why people, either individually or as groups, buy products or services and how they make a purchasing decision (Swarbrooke & Horner, 1999). The research of consumer behaviour examines a range of internal (e.g. attitudes, motivation and personality) and external (e.g. demographics or culture) influences on final decision-making process (e.g. purchase decision, brand awareness and loyalty, evaluation and post-purchase decisions) and the customer experience (e.g. the occasion, standards or benefits gained from the experience) (Mitchell & Hall, 2003).

Purchasing (or consumer) behaviour of customers in tourism sector is influenced by several factors. Most of the authors mention demographics, socioeconomic and lifestyle variables (Tsiotsou & Goldsmith, 2012). Hudson & Hudson used a depth analysis and defined seven main aspects: purchase motivation, culture, social status, demographic factors, lifecycle status, lifestyle and reference groups (Hudson & Hudson, 2017). A slightly different situation is when a customer is not a private person, but an organisation. In B2B tourism the customer is

purchasing the products or services, but someone else is consuming them. The typical examples of such products are congresses, conferences or trainings (Gucik et al., 2011).

### **2.3 The development and trends in tourists' preferences and purchasing behaviour**

UNWTO have created a brochure *Tourism Towards 2030*, where they defined the top trends for European Union for oncoming 10 years. It expects the average 1,5% growth rate of the arrivals into the Union – in total numbers more than a 1,8 bn arrivals in 2030 (UNWTO, 2018). However, the COVID-19 pandemic will, probably, disrupt these figures in a significant way.

One of the most significant changes in tourism sector is the rate of how much tourists use a middleman to purchase a customer experience. Tourists tend to purchase and execute their travelling activities alone, without any reseller or a third-party organization. They buy transportation and accommodation services on their own, as well as the food and beverages. The main reason for such trend is the feeling of freedom and independency (Sigalat-Signes et al., 2019). However, it is important to state, that there are several factors influencing tourists' preferences besides freedom and independency. The most significant ones are the product price, its availability or options for its online purchase (Cuculeski, Petrovska & Cuculeski, 2016).

Some authors define modern and future tourism as an ecosystem (Erumban & Das, 2016), (Scheafer, 2017). The ecosystem of tourism interconnects customers and businesses, who have deep mutual relationships, cooperation and/or competition, which, in the end, create a final product or service (Gretzel et al., 2015). These interconnection principles are at the base of many tourism innovations, e.g. e-tourism (Buhalis, 2008) or eco-tourism (Zeppel, 2006).

However, the WTTC explains, that not every aspect of future tourism will be positive. According to their publications, tourism sector will loose on a lack of talent, skills and creativity. As stated in their prognosis, more than 75% of developed countries will be impacted by the lack of educated and qualified workforce. The solution can be in tourism prioritization from the governments' sites, womenification and minorification of tourism, open policy, quality education or integration of modern technology into the sector (WTTC, 2019). Although the growth of the tourism industry is expected, the sector is not able to grow on its own. The businesses from associated sectors, such as insurance, hospitality, transportation, food and beverage or accommodation have to add a value and maintain and/or improve the quality of service offered to attract more customers (Singh, Vishnoi & Bagga, 2018). The main factor contributing to the industry growth should be more frequent and wider application of smart devices and technology (Xiang & Tussyadiah, 2014), which also enables the businesses operating in tourism industry better understand the tourists' needs and wishes (Maeda et al., 2016).

Therefore, we can interpret a 'new tourist', who has their own distinctive needs and behavior patterns. Such tourist is more dependent on information technology, self-service, and personal reservation tools. They value easier access to information technology, higher value for money and higher flexibility, choice options and personalization (Wang et al., 2016).

## **3 METHODOLOGY**

The main objective of the paper is to analyse the tourists' preferences regarding three activities related to tourism - purchasing of an accommodation, choosing the transportation method, and visiting the attractions/events in the destination. These preferences were analysed based on the Likert scale questionnaire, where the respondents had seven options to put in order based on their importance during the usual purchasing behaviour. The rating has seven points, where 1 (one) means 'the most important' and 7 (seven) means 'the least important'. To the research

purposes, we converted these values to a percentage, where 1 (one) means 100% and 7 (seven) means 0%, and other values accordingly. All the questions and options are shown in Tab. 2.

Tab. 2 – Questions and options used to identify tourists' preferences. Source: own research

Question	Options
When choosing an accommodation in the destination, the most important decision factor is its:	Price
	Location/distance to my point of interest
	Reviews, recommendations, own experience
	Brand and category of an accommodation
	Hotel restaurant/lobby, eating options
	Options for extra leisure time activities
	Availability of modern/smart technology
When choosing a transportation method to the destination, the most important decision factor is its:	Transport costs/price
	Way of transport (e.g. by a plane/car/train)
	Reviews, recommendations, own experience
	Travel service provider/airlines brand
	I prefer a travel agency to take care of the transportation method choice
	Its ecological impact
	Possibility to use smart/modern technology
When choosing an attraction/event to visit, the most important decision factor is its:	Ticket price
	Location/public transport availability/ distance to the accommodation
	Reviews, recommendations, own experience
	Availability of product package/product deal
	Availability of modern/smart technology
	Event/attraction propagation
	Attraction itself

We have identified these three activities and these options as the most appropriate, as they were the most frequented answers when the respondents were asked about planning their trip.

The data were being collected internationally in the period from January 2020 to March 2020 and we managed to gain 256 valid answers. After the virus started to spread rapidly, the collection was stopped to gain the most possible relevant data. The questionnaire was developed based on several already existing studies and was distributed through the social media, with the aim mainly at Generation Z users. The intention was to analyse and compare preferences and purchasing behaviour of Slovak tourists and the tourists from the EU and other parts of the world.

To identify the preferences, we have used simple descriptive statistics using MS Excel Pivot Tables to calculate means, medians and counts. To identify, whether selected demographical, geographical and economic factors have a significant influence on tourists' preferences, we have used Pearson Chi-Square testing in IBM SPSS Statistics software.

Based on the mentioned studies and our previous research we have developed three hypotheses. Their aim was to identify the influence of selected demographical and geographical factors on tourists' preferences:

H1: The selection of an accommodation based on an availability of smart technology in facility is significantly influenced by tourists' age.

H2: The importance of the use of smart technology in attractions/during the events is perceived differently by men and women.

H3: People from different world regions perceive the importance of smart technology in accommodation selection process differently.

## 4 RESULTS

### 4.1 Choosing the accommodation

When purchasing the accommodation, tourists have relatively high number of options to choose from. Whether it is hotel, motel, private accommodation or the shared economy tool (e.g. Airbnb), they are going through the process of purchasing decision. And this decision is in the end made with regard to several factors. Some of which were selected and respondents of our research expressed their opinion about them. This has helped us to identify the preferences. The means, medians and extreme values are shown in Tab. 3.

Tab. 3 – 'When choosing an accommodation in the destination, the most important decision factor is its:'

Source: own research

Option	Mean (%)	Median	Total 1's	Total 7's
Price	80,73	2	108	4
Location/distance to my point of interest	76,17	2	67	12
Reviews, recommendations, own experience	70,70	3	54	5
Hotel restaurant/lobby, eating options	44,40	5	11	9
Brand and category of an accommodation	40,30	4	3	19
Options for extra leisure time activities	22,53	6	2	47
Availability of modern/smart technology	15,17	7	11	159

As we can see in Tab. 3, the most important factors in decision of accommodation purchase are price, location and reviews or own experience. Medium values match the means, so we can consider these results as relatively reliable. However, by option 'Availability of modern/smart technology' we can see quite extreme values, as it was placed first 11 times (the same as 'Hotel restaurant/lobby, eating options', but 159 respondents find this option as the least important. Interesting is, that the total number of extreme values is highest right by this option. This can be explained by the sample, which consisted of respondents from different world regions, age or income groups.

### 4.2 Choosing the transportation method

Very similar situation is present when people are deciding what transportation method should they choose. This decision is also being made based on the one's preferences, which we tried to identify. Tab. 4 displays means, medians and extreme values for all the options.

Tab. 4 – 'When choosing a transportation method to the destination, the most important decision factor

is its:'. Source: own research

Option	Mean (%)	Median	Total 1's	Total 7's
Transport costs/price	82,62	1	137	19
Way of transport (e.g. by a plane/car/train)	68,75	2	55	8
Reviews, recommendations, own experience	66,28	3	27	1
Travel service provider/airlines brand	41,86	4	4	28
Possibility to use smart/modern technology	32,10	6	20	71
Its ecological impact	29,43	6	3	52
I prefer a travel agency to take care of the transportation method choice	28,97	5	10	76

Also the results are very similar to purchasing the accommodation. In this case, tourists' main decision factor when choosing a transportation method is price, followed by way of transport (preference of traveling by air, road, railways etc.) and reviews or own experience. The extreme values and their counts approximately comply with means and medians, however, the same situation as by the accommodation purchase occurred. The option 'Possibility to use smart/modern technology' has the second highest number of extreme values in total (91).

### 4.3 Choosing the attractions/events to visit

We have asked tourists why they usually choose their trip stops – mainly attractions or events in the destination. In this case, the number of possible attractions/events and reasons to visit them is much higher than in previous cases. However, we chose the following seven options, which are displayed together with means, medians and extreme values in Tab. 5.

Tab. 5 – 'When choosing an accommodation in the destination, the most important decision factor is its:'

Source: own research

Option	Mean (%)	Median	Total 1's	Total 7's
Ticket price	65,23	3	68	9
Attraction itself	63,35	2	88	38
Location/public transport availability/ distance to the accommodation	60,42	3	22	16
Reviews, recommendations, own experience	61,98	3	42	31
Availability of product package/product deal	38,61	5	2	21
Availability of modern/smart technology	32,10	6	33	66
Event/attraction propagation	28,32	6	1	74

The price seems to be the main decision factor in all three activities, in the case of choosing the attraction/event to visit it is followed by attraction itself, location or availability and reviews or own experience. In this case we expected the option 'Attraction itself' to be the main decision factor, however, it has relatively high number of negative extreme value (7) – 38. Very interesting point is, that exactly as in the previous questions, the total number of extreme values by 'Availability of modern/smart technology' option is very high.

### 4.4 Modern/Smart technology extreme values

To identify, what can be a cause for such high number of extreme values by all 'Modern/Smart technology' options, we have used a Pearson Chi-Square test. Its purpose was to identify, whether selected demographical, geographical and economic factors (Age, Gender, Region and Income) have a significant influence on tourists' preferences. Tab. 6 displays all the p-values from Chi-Square tests used to identify this influence.

Tab. 6 – Chi-Square test p-values. Source: own research in MS Excel

Chi-Square test	p-values			
	Age	Gender	Region	Income
Accommodation	0,068	0,415	0,000	0,861
Transportation	0,359	0,762	0,864	0,483
Attractions/Events	0,043	0,188	0,351	0,630

The p-values were compared with  $\alpha = 0,05$ , which is a value representing a confidence interval of 95%. Every value lower than  $\alpha = 0,05$  represents significant influence and vice versa.

As we found out, this influence can be considered significant only in two cases (green-highlighted) – the influence of 'Age' on 'Choosing the attraction/event to visit' and the influence of 'Region' on 'Choosing the accommodation'. Due to the counts of single answers from Tab. 7 and Tab. 8 we can summarize, that **the younger the tourists are, the more likely they are to prefer the attractions or events, which offer modern technology tools** (e.g. WiFi connection, Audioguide, Smartguide, App etc.).

Tab. 7 – Influence of age on attraction/event choice, counts of answers. Source: own research in IBM SPSS

		Attractions						Total	
		1	2	3	4	5	6		7
Age	18 - 24	16	6	4	9	19	37	37	128
	25 - 34	12	1	4	3	18	30	26	94
	35 - 49	5	0	0	0	9	5	3	22
	50 - 61	0	1	2	2	3	3	1	12
Total		33	8	10	14	49	75	67	256

An influence of tourists' region of origin is significant when choosing the accommodation. As we found out, for Slovak tourists the availability of modern/smart technology is not a decisive factor, while for tourists from Asia it is more important. The tourists from other European countries (grouped as EU) are in between.

Tab. 8 – Influence of region on accommodation choice, counts of answers. Source: own research in IBM SPSS

		Accommodation						Total	
		1	2	3	4	5	6		7
Region	ASIA	3	2	0	0	1	5	3	14
	EU	7	1	1	0	9	10	30	58
	SVK	1	6	2	6	14	29	126	184
Total		11	9	3	6	24	44	159	256

#### 4.5 Hypotheses evaluation

H1: The selection of an accommodation based on an availability of smart technology in facility is significantly influenced by tourists' age.

As Pearson Chi-Square test has proved, there is no significant influence in this case (p-value = 0,068; CI = 95%). The H1 hypothesis is rejected.

H2: The importance of the use of smart technology in attractions/during the events is perceived differently by men and women.

As Pearson Chi-Square test has proved, there is no significant influence in this case (p-value = 0,188; CI = 95%). The H2 hypothesis is rejected.

H3: People from different world regions perceive the importance of smart technology in accommodation selection process differently.

As Pearson Chi-Square test has proved, there is a significant influence in this case (p-value = 0,000; CI = 95%). The H3 hypothesis is accepted.

## 5 DISCUSSION

Our findings consist of several interesting parts. The first one is, that regardless of the travelling activity, tourists' main decision purchase factor is price of the product/service. This situation is the same around the world. We were a bit surprised, that even when choosing an attraction or event to visit, tourists' main decision factor was price, while the attraction/event itself was a runner up. In a simplified way it can be said, that tourists do not choose what they really want to visit, but what is cheaper instead.

The next interesting finding is the fact, that modern or smart technology is not such an important decision factor as we supposed. However, with the spread of global pandemic of COVID-19 disease it is likely to change, what could represent an interesting study. This paper can act as a pre-pandemic base, which could be later, after the pandemic ends, compared with another study

to research the change of tourists' preferences. It also brings a current perspective into the literature and theoretical knowledge available to the topic. The main theoretical contribution is represented by an actual real-time data from pre- and post- pandemic state of tourism industry supported by the theoretical inclusion of actual tourism trends and purchasing behaviour of tourists around the globe.

However, this research has several limitations. The most significant one is its sample, which consists only of 256 respondents, while more than 70% of the sample are tourists from Slovakia. Another limitation can be the pandemic itself, because in some countries the virus was already spreading when we were collecting data. Thus, the results can be (in a certain rate) influenced by this situation. However, this research is meant to be further elaborated. It is planned to deeply analyse the changes in tourists' purchasing behaviour and preferences regarding the spread of coronavirus, with the main focus of perception and usage rate of modern technology tools.

## 6 CONCLUSION

By this paper we tried to better understand tourists' purchasing behaviour, specifically when purchasing accommodation services, transportation services and choosing the attractions and events to visit. Purchasing behaviour and decisions differ from customer to customer, from the country to country and from the sector to sector. However, the tourism is very specific and flexible sector, where these differences are even bigger. This research is a great example. Despite the fact, that a price is the most important decision factor in all researched travelling activities, we also identified that modern and smart technology do not play a vital role in the decision-making process. However, this, as we said, differs from country to country and from the person to person. We have identified, that the age is quite significant factor when tourists choose the attractions or events to visit in the destination. The research shows that the younger the tourists are, the more likely they are to look for the attractions which have adopted modern technology tools. Also when choosing the accommodation, tourists from different world regions perceive the importance of modern technology. More specifically, for tourists from Asian countries the possibility of having an accommodation facility mobile app, smart guide or virtual tour of the facility is much more important than for tourists from other world regions. These results just proved, that when businesses operating in tourism sector act internationally, it is vital to know their customers not only as numbers in their income statement, but as people with different preferences, needs and wishes.

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# DO EQUITY CHARACTERISTICS MATTER FOR CORPORATE SOCIAL RESPONSIBILITY? EVIDENCE FROM CHINESE APPLIANCE COMPANIES

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## **Abstract**

With the growing environmental problems in China, the issue of corporate social responsibility (CSR) is getting more and more attention. China's home appliance industry is one of the few internationally competitive industries in China. The CSR of Chinese home appliance companies is not only related to their international image, but also to their long-term development. Therefore, it is worth exploring which factors will affect their CSR levels. However, there is very little literature on this issue. In an effort to help fill this gap, this study aims to investigate the relationship between the equity characteristics and the level of CSR implementation of Chinese home appliance companies. The equity characteristics involved in this article include the identity of the largest shareholder and equity ownership concentration. The sample consists of 59 Chinese appliance companies listed before 2018. The level of CSR implementation is assessed by an evaluation criteria system created by the author according to the features of the household appliance industry. Multiple linear regression results indicate that equity ownership concentration affects the level of CSR implementation negatively. While the identity of the largest shareholder, regardless of the state or family major shareholder, is insignificant to the level of CSR implementation.

*Keywords:* CSR, state-owned enterprise, family business, equity ownership concentration

## **1 INTRODUCTION**

As China's environmental and social issues become more and more serious, corporate social responsibility (CSR) has become one of the main concerns of the government and the public. Since 2006, the Shenzhen Stock Exchange and the Shanghai Stock Exchange have gradually issued various guidelines to encourage listed companies to establish corresponding social responsibility mechanisms and disclose relevant information to the public. After more than ten years of development, according to the "Corporate Social Responsibility Blue Book" published by the Chinese Academy of Social Sciences (CASS, 2018), the overall status of CSR implementation in China has changed from the bystander stage to the initial stage. This result indicates that the whole situation of CSR implementation in China has improved, but it is still not ideal. Exploring which factors may affect the implementation of CSR has become one of the focuses of scholars. Existing research examines the relationship of CSR with profitability (Giannarakis, 2014; Alnajjar, 2000), corporate governance (Jain & Jamali, 2016; Jizi et al., 2014) and ownership structure (Dam & Scholtens, 2012; Swandari & Sadikin, 2016) and so on. The home appliance industry is one of the few internationally competitive industries in China. To the best of our knowledge, there is currently little literature dedicated to studying the determinants of the social responsibility of Chinese home appliance companies. In order to fill this gap, this study attempts to explore which factors will affect the CSR level of Chinese home appliance companies from the perspective of equity characteristics.

The study takes the Chinese appliance listed companies in 2018 as a sample and deals with the impact of equity characteristics on their CSR level. According to the features of the home appliance industry, an evaluation criteria system is established based on the content analysis of

CSR report, financial reports and websites. It is constructed to obtain the ranking score as the proxy for the level of CSR implementation. Regression analysis is conducted to test hypotheses that link the level of CSR implementation and specific-related corporate determinants by SPSS software. The results show that equity ownership concentration is a significant equity characteristic that negatively affects the level of CSR implementation. However, the identity of the largest shareholder does not influence the level of CSR implementation, no matter it is a state-owned shareholder or a family shareholder. This study expands the CSR literature by focusing on the home appliance industry and provides new directions for future research.

The rest of the study is described below. The next section reviews the existing literature on the relationship between CSR and equity characteristics, and propose hypotheses. In section 3, we introduce samples, data and applied model. Section 4 lists the empirical results and discusses them in section 5. In the last section, we provide some conclusions and then point out the direction of further research.

## **2 LITERATURE REVIEW**

Academic research on CSR began to take form in the 1950s (Carroll, 2009). A numerous number of scholars and organizations strive to define the concept of CSR. So far, there is still no commonly accepted definition of CSR. This paper adopts the concept of CSR advocated by Elkington in 1997 based on the so-called triple bottom line principle. He assumes that if an enterprise forms an economic and social system, then its development objectives should constitute a triple beam, which relates to the profit, the people associated with the company, and cares for the planet. Since the 1980s, with the increasing importance of financial market and corporate governance research, equity characteristics have become a new research area as one of the possible determinants of CSR (Faller & zu Knyphausen-Aufseß, 2018).

### **Identity of the largest shareholder**

As the in-depth development of the Chinese state-owned business reform, a situation rises that state invests in the form of the pension fund or other fund emerge in private business and private invests appears in state-owned enterprises. Nevertheless, a distinct characteristic of Chinese listed companies is that they have a single dominant shareholder whose ownership far exceeds that of the second-largest shareholder (Chen, Firth & Xu, 2009). Therefore, the identity of the largest shareholder determines the type of firms. The dominant shareholder determines the strategy-making tone of the board of directors, further controls the development directions of companies. Given the actual situation of the largest shareholder of Chinese home appliance listed companies mainly involve state-owned shareholders and family shareholders. The following part discusses only the impact of these two types of controlling shareholders on CSR.

Socio-political theories, which are often applied in research about firms controlled by the state, argue that block-holders could urge companies to issue CSR report due to the following reasons. We can introduce due Cao, Peng and Ye (2019) for instance their political connections with government, their need to obtain a better social image, their consideration for public visibility, or their incentives to avoid negative consequences. Hence, a high level of CSR can be expected in state-owned companies. However, CSR is also possible at a low level in such kind of firms. These firms are usually separated from market mechanisms and have immature corporate governance structures; these conditions can be expected to limit consciousness and considerations regarding stakeholder wishes and CSR-oriented expectations (Qiu, 2013; Zhang, Rezaee & Zhu, 2010).

Cordeiro et al. (2018) use 500 large Indian companies to test the effect of corporate ownership forms on CSR engagement, and find that state-owned enterprises are negatively related to the

participation of CSR, which may be due to the lack of managers' incentives or project management skills. Existing research also offers empirical evidence to support the negative relationship between CSR and state-owned companies in China. It was found that in view of the literature review made by Faller and zu Knyphausen-Aufseß (2018), a generally positive relationship between CSR and state-owned firms exists in a large sample which involves European countries. But none of the four Chinese studies shows positive correlations. They got the conclusion that 'country-specific differences can play a major role in the relationship between state equity ownership and CSR'. This conclusion is supported by the findings of Zhang, Rezaee and Zhu (2010), which is based on the company's response to the disaster of the 2008 Sichuan earthquake. The extent of corporate contributions for state-owned firms to this disaster is less than that for private firms. Compared with private companies, state-owned companies are also less likely to respond to this disaster.

Organizational identity theory is commonly used in the research of family-controlled companies. It believes that individuals who are closely related to the organization pay more attention to company reputation because it is closely related to personal reputation and image. (Bingham et al., 2011). Hence, the family business is considered to prefer to improve the impression of the firm in public through better implementing CSR. However, family shareholders may be reluctant to participate in CSR activities because most of their wealth is related to the company's financial performance, and engagement in CSR may incur short-term costs (Sirsly & Sur, 2013).

A large amount of extant research shows a positive relationship between CSR and family firms. López-González, Martínez-Ferrero and García-Meca (2019) take an international sample from 2006 to 2014, and get the result that family firms behave towards CSR in order to preserve their socio-emotional wealth. Bingham et al. (2011) find that family and non-family firms demonstrate noteworthy differences in terms of social initiatives and social concerns. Esparza Aguilar (2019) takes a sample from Mexican companies and finds that the family small and medium-sized enterprises (SMEs) develop CSR practices to a greater extent than non-family ones, especially on environmental and societal dimensions.

Hence, in summary, it is predicted that state-owned enterprises do worse than non-state-owned enterprises in the perspective of CSR. In contrast, the family business does better than non-family business. The following research hypotheses are stated.

*H1a: State-owned enterprises are expected to demonstrate less social responsibility than non-state-owned enterprises.*

*H1b: Family firms are expected to demonstrate more social responsibility than non-family firms.*

### **Equity ownership concentration**

Agency theory believes that the controlling shareholder may exploit the benefits of minority shareholders, which results in an entrenchment effect (Maury & Pajuste, 2005). In the light of the entrenchment effect, when an action such as CSR reporting adds economic costs for controlling shareholders, they would have minimal incentives to disclose CSR information (Cao, Peng & Ye, 2019). Under such circumstance, the relationship between the CSR and concentrated equity ownership should be negative.

Previous empirical studies have provided substantial evidence that the higher the concentration of equity, the less the company's CSR engagement. Ducassy and Montandrou (2015) investigate listed companies in France and find that centralized ownership had a negative impact on social performance because large shareholders were reluctant to spend money on CSR, even if it

would benefit all stakeholders. Based on the results of the literature review made by Faller and zu Knyphausen-Aufseß (2018), seven out of thirteen studies are showing negative correlations between CSR and equity ownership concentration. Those studies are showing positive correlations at this point focus on listed firms in a single Asian at the beginning of the 21st century. However, most recent research results update this conclusion that the degree of equity ownership concentration affects the level of firms' CSR engagement negatively based on Chinese listed companies (Cao, Peng & Ye, 2019; Li et al., 2013). As a result, it is predicted that as the equity ownership concentration increases, the level of CSR decreases. The hypothesis is formulated as follows.

*H2: The degree of equity ownership concentration is negatively associated with the firms' CSR.*

### **3 METHODOLOGY**

#### **Sample and Data**

This paper aims to explore the impact of equity characteristics on the level of CSR implementation in the Chinese appliance industry. Thus, the study selects the Chinese home appliance listed companies for the year 2018 as the research object. The companies list is taken over from the Iwencai database. After excluding the companies listed in 2018 and 2019 and insolvent companies, a sample of 59 listed companies is left. Precisely, it consists of 26 companies listed on the Main Board, 25 companies listed on the Small and Medium Enterprise Board, and 8 companies listed on the Growth Enterprise Market (GEM). All data are collected from Iwencai database, annual financial statements and CSR reports (if any).

#### **Dependent variable**

Vast previous literature on China's CSR research has selected the overall evaluation score published by Rankins CSR Ratings (RKS). It is a reliable CSR rating agency in China for a measurement of the performance and disclosure of CSR (Marquis & Qian, 2014; Hao, Qi, & Wang, 2018). However, there is a flaw in the RKS rating results that it cannot cover all listed companies. It is because RKS evaluated the CSR of listed companies based on the CSR reports issued by the companies, but not every listed company is able or willing to disclose its CSR report for various reasons. Given the fact that the necessary sample data in this study cannot be obtained from this reliable rating report, this paper constructs an evaluation criteria system based on the characteristics of appliance industry to assess the CSR implementation status of the Chinese appliance listed companies. According to this triple bottom line principle advocated by Elkington mentioned earlier, the paper sets the evaluation criteria system from the three aspects of economics, environment and society as well as their subdivisions. Reasons and analysis for these criteria selection and the assignment of the specific weights for each criterion can be found in the author's another paper (Wu, 2019). The majority of the original data is manually collected by the author from the annual report and CSR report; the rest of the data used is from Iwencai database. The final CSR score of each Chinese home appliance listed company is a sum of the products of each normalized indicator value and its global weight.

#### **Model**

Since data only has a cross-sectional dimension, a multiple linear regression model is proposed to test the hypotheses formulated in the previous section. This model is considered an appropriate analytical tool when the dependent variable is a measurable and continuous one, and the independent variables are measurable continuous or dichotomous ones. Thus, the empirical model is provided as follows,

$$CSR = \beta_0 + \beta_1 SOE + \beta_2 FB + \beta_3 BSR + \beta_4 FS + \beta_5 ROE + \beta_6 FR + \varepsilon \quad (1)$$

where  $\beta_0$  is the intercept,  $\beta_1, \dots, \beta_n$  represent the regression coefficient,  $\varepsilon$  is the error term. All the variables included in the model are listed and described in detail in Tab. 1.

Tab. 1 – Summary of variables and their measurements in the study. Source: own research

Name of variables	Abbreviation	Measurement
CSR	CSR	CSR score calculated by AHP method
Independent variables		
State-owned enterprise	SOE	Dummy variable (value 1 = stated-owned enterprise, value 0 = otherwise)
Family business	FB	Dummy variable (value 1 = family business, value 0 = otherwise)
Equity ownership concentration	BSR	The shareholding ratio of the largest shareholder
Controlling variables		
Firm size	FS	The natural logarithm of total assets
Profitability	ROE	Net income/total equity
Financial risk	FR	Total debts/ total assets

## 4 RESULTS

### Descriptive statistics

Tab. 2 shows the descriptive statistics of all variables in the study. The CSR level varies from 0.06 to 0.66, with a mean of 0.39 and a standard deviation of 0.14. Statistics show that in 2018, state-owned enterprises accounted for 17% of China's home appliance industry, and family businesses accounted for 63%, which indicates that family business is the main body of China's home appliance industry. Block-holder shareholding ratio range between 7.82% and 81.18%, with a mean of 36.84% and standard deviation of 16.88.

Tab. 2 – Descriptive statistics of given variables. Source: own research

	Minimum	Maximum	Mean	Std. Deviation
CSR	0.06	0.66	0.39	0.14
State-owned enterprise	0.00	1.00	0.17	0.38
Family business	0.00	1.00	0.63	0.49
Blockholder shareholding ratio	7.82%	81.18%	36.84%	16.88
Firm size	19.74	26.30	22.43	1.45
Profitability	-105.00%	34.79%	1.46%	26.55
Financial risk	0.15	0.86	0.47	0.19

### Correlation analysis

Tab. 3 presents Pearson's correlation analysis results among all variables with their significance level. When the correlation coefficient between regressors is above 0.80, it is considered as an indication of serious multicollinearity (Guajarati & Porter, 2004). In this study, the maximum coefficient of the Pearson correlations between independent variables is 0.597; thus, multicollinearity does not exist in this sample data.

Tab. 3 – Pearson correlation matrix. Source: own research

	CSR	SOE	FB	BSR	FS	ROE	FR
CSR	1						
SOE	0.363**	1					
FB	-0.304*	-0.586**	1				
BSR	-0.108	-0.133	0.137	1			
FS	0.492**	0.433**	-0.358**	-0.098	1		
ROE	0.408**	0.114	-0.106	0.407**	0.168	1	
FR	0.197	0.363**	-0.269*	-0.2	0.597**	-0.395**	1

Note: \*Significant at the 0.05 level (two-tailed); \*\*Significant at the 0.01 level (two-tailed).

### Regression results

Before testing the hypotheses, this study satisfied classical linear regression assumptions for cross-sectional data. Particularly test for homoscedasticity, the normality of the residual and multicollinearity. Regarding the homoscedasticity test, we can see the result of the LM statistic from Tab. 4 is not significant at the 5% level. It means, that there are no heteroscedasticity concerns. For examining the issue of the normal distribution of residuals, Fig. 1 shows us an intuitive answer that the residuals are normally distributed.

Tab. 4 presents the results of regressing the CSR level of the Chinese appliance listed companies on the independent variables by ordinary least square. R-squared of the regression model is 0.430, which means that all the independent variables together explain about 43% of the variance in the CSR level of the Chinese appliance listed companies. The p-value of the F statistics is less than 0.001, which means all the independent variables are jointly significant in this model.

Tab. 4 – Regression results. Source: own research

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.067	0.321		-0.210	0.835
State-owned enterprise	0.032	0.051	0.086	0.622	0.537
Family business	-0.010	0.037	-0.035	-0.267	0.791
Blockholder shareholding ratio	-0.207	0.099	-0.251	-2.092	0.041
Firm size	0.021	0.016	0.214	1.323	0.192
Profitability	0.003	0.001	0.535	3.458	0.001
Financial risk	0.142	0.131	0.190	1.086	0.282
<hr/>					
R <sup>2</sup>	0.430				
Adjusted R <sup>2</sup>	0.364				
F-statistic	6.538				
Probability (F-statistic)	0.000				
White test for homoscedasticity (the LM statistic)	Obs*R <sup>2</sup> =3.186				
	p= 0.2033				

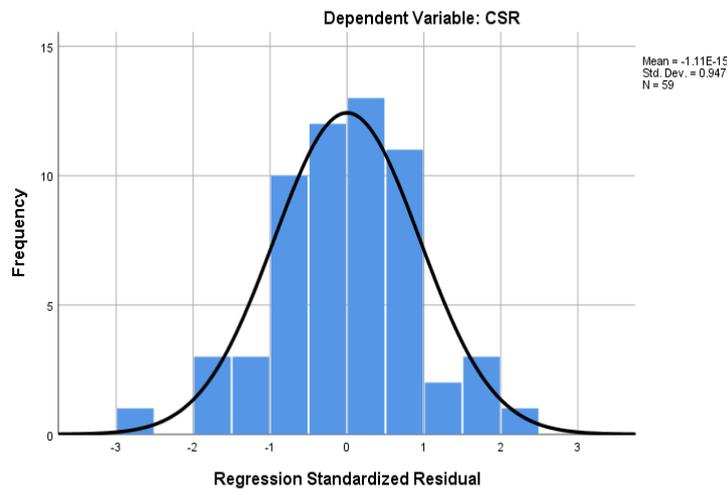


Fig. 1 – Histogram of residuals. Source: own research

As can be seen from the results reported in Tab. 4, both state-owned enterprises and family enterprises are insignificant at the 5% level. Block-holder shareholding ratio is negatively associated with CSR at the 5% level. Specifically, an increase in block-holder shareholding ratio leads to a decline in CSR by 0.207 points. Inconsistent with our expectation, state-owned enterprises and family enterprises are not associated with CSR. As for the control variables, only profitability is significantly and positively correlated with CSR at the 1% level, whereas firm size and firm financial risk are insignificant even at the 10% level.

## 5 DISCUSSION

According to the regression results, we know that the identity of the majority shareholder, regardless of state-owned shareholder and family shareholder, is not associated with CSR. This kind irrelevant relationship of block-holder to CSR is a violation of the previous hypothesis and inconsistent with the findings of Esparza Aguilar (2019), Dou, Su and Wang (2019) and Faller and zu Knyphausen-Aufseß (2018). This result may be linked to the development stage of the company. On the one hand, the state-owned enterprises in the sample are polarized, that is, some state-owned enterprises, especially those at a mature stage, have higher CSR scores. In contrast, some state-owned enterprises, especially those in a state of recession or on the verge of bankruptcy, have lower CSR scores.

On the other hand, some family firms in the sample, especially listed on the Growth Enterprise Market (GEM), are in the start-up phase or the transition period from the start-up to the growth phase, so they focus on pursuing profit and pay less attention to the issues of CSR. However, some family businesses at a mature stage are more willing to invest in CSR. Therefore, there is no clear relationship between the identity of the majority shareholder and CSR in this study.

Equity ownership concentration, measured by block-holder shareholding ratio, is significantly and negatively correlated with the level of CSR. It means the higher the shareholding of the largest shareholders, the lower the level of CSR. This result supports Hypothesis 2 and is consistent with previous research (Cao, Peng & Ye, 2019; Dam & Scholtens, 2013). The causality behind this finding is with Dam and Scholtens (2013) explained that 'corporate social performance can be viewed as the private provision of public goods'. If major shareholders improve CSR policy possibly at the cost of their financial gains, other stakeholders except themselves may benefit. In this sense, significant shareholders privately provide a public good. Therefore, the higher the shareholding of block-holders in a firm, the lower their initiative to

practise CSR since the benefits for the major shareholders do not outweigh the costs, even if the initiative is socially optimal.

## 6 CONCLUSION

This study has shown how equity characteristics affect the CSR of Chinese home appliance companies. The regression results showed that the higher the concentration of equity, the lower the level of CSR, and the identity of the largest shareholder, whether it is a state-owned shareholder or a family shareholder, does not affect the CSR of Chinese home appliance companies. This latter result shows that it is not enough to consider only the influence of the identity of the majority shareholder on CSR, and a more reasonable and clear relationship may be obtained in combination with the company's development stage. It provides a new direction for future research.

This study has some limitations that can be overcome by further research. First, this paper just took one year of sample data for the analysis; future study will extend the study period. Second, we studied equity characteristics in terms of the identity of the largest shareholder and equity ownership concentration. Future research may focus on non-controlling large shareholders and equity structure.

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# VALUATION OF INSURANCE CONTRACTS BY VFA METHOD UNDER IFRS 17

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## **Abstract**

The aim of the paper is to clarify the variable fee approach (VFA) method from the IFRS 17 standard and to show on a concrete example the valuation of insurance contracts according to this method. Author describes the VFA method on a theoretical level, explains and applies it using actuarial calculations on a selected portfolio of unit-linked life insurance contracts. The study was based on a set of anonymised data of an insurance company operating in Slovakia; however, because each insurance company has its own portfolio subject to changes over time, the results of this research will not apply to all insurance companies. Author also defines the conditions for the use of the VFA method, the underlying items, the separation of investment components and characterizes a separate service component. Author describes the VFA model itself and the possible way it can be used in life insurance. Author quantifies two new variables defined in IFRS 17, namely the contractual service margin and the risk adjustment. Their subsequent reporting, development and the calculation itself will be the subject of the paper results. The impact of the new values that will be calculated and subsequently reported in the balance sheet and in income statement is significant. The new structure of the balance sheet and income statement is one of results of this research.

*Keywords: IFRS 17, unit-linked products, variable fee approach, contractual service margin, risk adjustment.*

## **1 INTRODUCTION**

The International Accounting Standard Board (IASB) issued in 2017 a new International financial reporting standard IFRS 17 – Insurance contracts, which sets out the principles for the reporting, valuation, presentation and disclosure of insurance contracts. The intent of IFRS 17 is to ensure that an entity discloses information that consistently represents the substance of the underwritten insurance contract. The new standard, which comes into force on 1.1.2023, applies not only to newly established insurance and reinsurance contracts, but also to existing ones in the insurance portfolio. IFRS 17 is intended to provide more transparent information about the profitability and favourability of insurance products, while fully replacing the current IFRS 4 standard.

IFRS 4 applies to all insurance contracts and their provisions, with the exception of those insurance contracts, that do not contain a material insurance component. Insurance contracts that do not have a material insurance component and do not include a discretionary share of income are governed by IAS 39 (International Accounting Standard 39 - Financial Instruments). IAS 39 requires an entity to separate some embedded derivatives from their host contract, measure them at fair value and include changes in their fair value in profit or loss. IAS 39 applies to derivatives embedded in an insurance contract unless the embedded derivative itself is an insurance contract. However, this standard has been replaced by IFRS 9 (Financial Instruments) as of 1 January 2018. IFRS 9 represents an improvement over IAS 39, because it refrained from the loss-based model and adopted an expected loss-based depreciation model which solves the problem of late adoption of too weak measures in the credit loss recognition

procedure. An insurance company may apply IFRS 9 now with IFRS 4, or it may remain with IAS 39 and start applying it simultaneously with IFRS 17 (Buzgová, 2016).

IFRS 17 will mainly affect the areas of finance in the insurance company, namely the departments of actuarial mathematics, accounting, risk management and information systems. It will to some extent also intervene in other departments, such as product design and distribution, development of revised procedures to increase motivation and wider remuneration, or budgetary and forecasting methods introduced into business planning. There is also an impact on taxes and dividends, either on transition or later.

Within the insurance sector, the concept of future solvency regulation within the European Union is set out in the Solvency II project. Its implementation requires systematic and complex risk management. The risk, in financial area, more-accurately the area of market transactions with assets, is about the volatility of stochastic processes, which have influence to profit of companies. During development of risk management many tools of measurement had brought into being. The raising volatility of exchange rates, interest rates and prices of commodities caused demand on creation of new financial and analytics tools. (Kaderová, Krátka, Pálež, 2018). Explanation of risk margin under Solvency II and risk adjustment under IFRS 17 are mentioned in e.g. (England, Verrall, Wüthrich, 2019).

This article is about the valuation of unit-linked products in insurance portfolio and used methods follows the methodology described in standard IFRS 17. The aim is to display the variable fee approach (VFA) method and calculate the expected profit during the insurance period of selected insurance contracts, because one of the objectives of the standard is to release the insurance company's profit over several time periods.

## 2 THEORETICAL BACKGROUND

Each insurance company is obliged to justify the choice of accounting policy and the way of using the method of valuing insurance contracts. IFRS 17 defines 3 methods of valuing insurance contracts. Each has its own characteristics, as shown in Table 1. Building block approach (BBA) and variable fee approach (VFA) are methods required to use for insurance company. Only PAA (premium allocation approach) is voluntary and the insurance company does not have to apply it. At the same time, the PAA method is also the simplest. For reinsurance contracts can be applied only BBA and PAA methods. These methods are also described in detail e.g. (Widing, Jansson, 2018). BBA method is critically analysed in e.g. (Ewelt-Knauer, Kraft, Schneider, 2018) or critical point of view of preparing this standard explains (Altenburger, 2011).

Tab. 1 – Valuation methods under IFRS 17. Source: own research under IFRS 17

<b>BBA</b>	<b>PAA</b>	<b>VFA</b>
default model for insurance contracts	liabilities from future claims for short-term contracts	insurance contracts with direct participation features*
traditional life insurance without DPF (discretionary participation feature)	short-term non-life insurance contracts	investment contracts
traditional life insurance with a (non) guaranteed DPF	some long-term non-life insurance contracts	* a direct link between the attributed profit share and the fair value of the underlying assets
reinsurance contracts	reinsurance contracts	

The selection of insurance contracts to be measured by the VFA is subject to the fulfilment of certain criteria defined in IFRS 17. The general definition of insurance contracts for life insurance products for which the VFA method will be used are: (a) Index-Linked insurance

contracts, (b) Unit-Linked insurance contracts, (c) Insurance contracts with profit share, (d) Variable annuities contracts, and (e) Universal life contracts.

IFRS 17 defines a term underlying item. Insurance contracts, in which the insurance company shares additional risks and rewards the policyholder at its discretion are called profit-sharing contracts. Profit sharing can be based on specific assets, groups of assets, profit from a fund or company. These profit-sharing items are referred to as underlying items. Variable fee - VF for investment services is the obligation of the insurance company to pay the policyholder amount equal to 100% of the underlying asset minus the variable fee. The variable fee is equal to the share of the insurance company reduced by all expected cash flows that do not change directly with the underlying items (e.g. expenses, time value of options and guarantees) that are part of the release of the contractual service margin (*CSM*). The *CSM* is releasing based on time.

In paragraph B101 in IFRS 17 are defined the conditions for insurance contracts with direct participation features (includes unit-linked products). Insurance contracts with direct participation features are insurance contracts that are substantially investment-related service contracts under which an entity promises an investment return based on underlying items. “Hence, they are defined as insurance contracts for which (cited from IFRS 17, 2017): (a) the contractual terms specify that the policyholder participates in a share of a clearly identified pool of underlying items; (b) the entity expects to pay to the policyholder an amount equal to a substantial share of the fair value returns on the underlying items; and (c) the entity expects a substantial proportion of any change in the amounts to be paid to the policyholder to vary with the change in fair value of the underlying items.”

Products with direct participation must have clearly assigned underlying items, the client participates significantly to the profit of the portfolio and the value of the liability develops according to the underlying items. The same contract may be valued under the VFA under certain conditions and may not meet test VFA eligibility under certain other market conditions. A typical feature of the VFA method is the separation of insurance contracts components and the interaction with the contract boundaries.

## **2.1 Separation of insurance contract components**

The definition of an insurance contract is the same as now applicable IFRS 4 standard. “A contract under which one party (the issuer) accepts significant insurance risk from another party (the policyholder) by agreeing to compensate the policyholder if a specified uncertain future event (the insured event) adversely affects the policyholder.” (extract from IFRS 17, paragraph B2, 2017)

Under IFRS 4, insurance contracts were not split. According to IFRS 17, insurance contracts are divided into insurance and investment components, at the same time, it will be separated the so-called service component of the insurance contract. However, not every component will be accounted for in accordance with IFRS 17. If the investment component is non-distinct to the insurance component, the contract will be measured under IFRS 17, but the components will be monitored separately. However, if the investment component acts separately, it will be separated from the contract and will be measured under IFRS 9 - Financial Instruments. A separate service component will be valued under IFRS 15 - Revenue from Contracts with Customers. Investment components are defined as monetary amounts that are required under the insurance contract to be paid to the policyholder in spite of all the circumstances.

### **Distinct investment components**

“Distinct Investment Component exists when: (a) the investment component and the insurance component are not highly unrelated, (b) contract with equivalent terms is sold, or could be sold,

separately in the same market or the same jurisdiction, either by entities that issue insurance contracts or by other parties.” (IFRS 17, paragraph B31, 2017)

“Insurance and investment component are highly interrelated if, and only if: (a) one component cannot be valued regardless of the other or (b) the policyholder cannot have income from one component unless the other is present (i.e. the extinction or survival of one component means the extinction or survival of the other component as well). “(IFRS 17, paragraph B32, 2017)

### **Separation of investment components**

In the case of traditional life insurance (insured death and also endowment), the highly interrelation of the insurance and investment components is visible. In this case, they do not need to be separated.

However, in unit-linked life insurance, the following cases may occur: (a) the amount of the insurance component depends on the value of the fund, death insurance is also compulsory for investment, the entire contract expires upon termination of the death insurance - separation is not necessary; (b) the amount of the insurance component is independent of the value of the fund, the investment can be concluded even without death insurance (voluntary conclusion of death insurance for investment), termination of death insurance does not terminate the contract, investment component continues - separation is necessary.

### **Separate service component**

The service promised to the policyholder is distinct if the policyholder can benefit from the goods or services alone or together with other readily available resources sold to the policyholder separately. The service promised by the insurance company to the policyholder is non-distinct, if the cash flows and risks associated with the service are interconnected with the insurance components in the contract. This is also the case if the entity provides a significant service in integrating goods or non-insurance services with insurance components.

Initial recognition and contract boundaries are important terms defined in the standard. A liability from a group of contracts is reported at the most extreme of the following moments: (a) at the beginning of the insurance coverage of a group of contracts, (b) at the due date of the first premium in the group of contracts, (c) at the date on which the group of onerous contracts became onerous.

## **2.2 Investment contracts with a discretionary participation feature**

Investment contracts with a discretionary participation feature (DPF) are financial instrument that provides a particular investor with the contractual right to receive, as a supplement to an amount that is not subject to the discretion of the issuer, additional amounts: (a) that are expected to be a significant portion of the total contractual benefits, (b) whose amount or timing is contractually at the discretion of the issuer, (c) that are contractually based on: the returns from a specified pool of insurance contracts, investment returns on a specified pool of assets held by the issuer, or the profit or loss of the entity or fund that issues the contract.

The allocation of additional insurance benefits is the choice of the insurance company. Many of these investment contracts with a discretionary participation feature qualify as profit sharing contracts. However, if the VFA method should be applied to those contracts, the criteria for using the VFA method must be tested.

## **3 METHODOLOGY**

If an entity decides to use the VFA method for insurance contracts, those insurance contracts must fulfil the VFA eligibility test defined in the standard. The requirements are (Tools4f,

2019): (a) using expectations at inception of the contract, (b) considering the cash flows that the entity expects to pay to policyholders, (c) assess the variability in the amounts: (i) over the duration of the group of insurance contracts, (ii) on a present value probability-weighted average basis, not a best or worst outcome basis.

**3.1 Characteristics of the VFA model**

The VFA model is a modification of the general model (BBA) and was designed for investment contracts with direct participation feature. Both models are mandatory for the insurance company if valuated products that meet the criteria for these models. In the VFA model, which is similar to the BBA model, are calculated the same values, but underlying items are given, which are on the assets side and are directly linked to liabilities.

The entity’s liability to the policyholder is equal to (IFRS 17, paragraph B104, 2017): (a) The fair value of the underlying items that the entity is required to pay to the policyholder. MINUS (b) Variable fee, that the entity deducts in exchange for future services provided by an insurance policy including: (i) The share in the fair value of the underlying items (the insurance company will keep it for itself). (ii) Fulfilment cash flows that do not vary based on the returns on underlying items. (insurance remuneration).

Figure 1 illustratively shows the initial recognition of liability by VFA model. The fair value of the assets is zero at the beginning of the period. The values *CSM* and *RA* (risk adjustment) at the initial recognition of the insurance contract are the same for the VFA model and for BBA. In each subsequent period, it is already different in these valuation methods.

Subsequent measurement is shown in the figure 2, where are underlying items already displayed, in which the client's insurance premium was invested. Their fair value is equal to the value of the fund. The variable fee is equal to the share of the fair value of the underlying items. The VFA model applies to any new insurance contract that meets the eligibility test. The insurance company has a share in the change in the fair value of the underlying items.

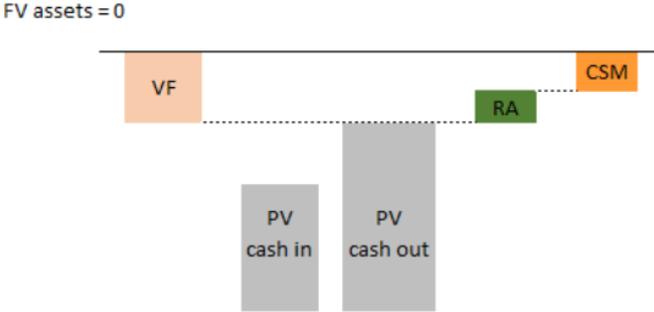


Fig. 1 – Liability valuation at initial recognition by VFA model. Source: www.tools4f.com

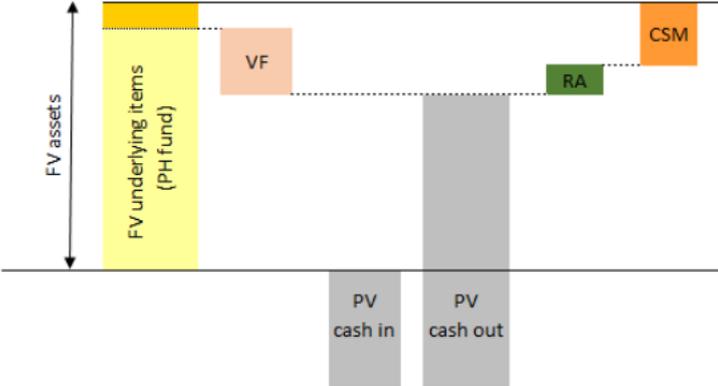


Fig. 2 – Liability valuation at subsequent measurement by VFA model. Source: www.tools4f.com

Changes in future cash flows adjusted for discount and risk adjustment (fulfilment CF) apply to future services and the current discount rates apply. The VFA model displays all exchange rate differences as well as transfers of services between periods. Changes in fulfilment cash flows that do not vary based on returns on underlying items consist of: (a) changes in estimates of the fulfilment cash flows, (b) the change in the effect of the time value of money and financial risks not arising from the underlying items, for example financial guarantees (IFRS 17, paragraph B113, 2017).

Changes in the obligation to pay the policyholder an amount equal to the fair value of the underlying items to not relate to future service and do not adjust CSM (IFRS 17, 2017). PVVF – present value of variable fee expresses the amount part of which the insurance company keeps for itself and the other part consists of fulfilment cash flows that do not depend on the underlying items. Author calculates PVVF, CSM and RA according to formulas (1), (2), (3), based on actuarial research of (Sakálová, 2001), (Sekerová, Bilíková, 2007), and (SSA, 2019). The author is a member of the Slovak Society of Actuaries (SSA).

$$PVVF_t = \frac{PVVF_{t+1} + Mch_{t+1} - SI(death)_{t+1}}{1 + i_t} + alloc_{t+1} + surr_{t+1} - exp_{t+1} \quad (1)$$

$$RA = NoP * risk\ factor * averageSI \quad (2)$$

$$CSM = PVVF_{NB} - RA_{NB} \quad (3)$$

where the individual symbols mean:

*Mch* – fund management charge expresses the fee for the management of the fund

*SI (death)* – sum insured in case of death

*alloc* – allocation is the part of the premium that is invested in the selected underlying item

*surr* – surrender charge

*exp* – expenses

*RA* – risk adjustment

*CSM* – contractual service margin

*PVVF<sub>NB</sub>* – present value of variable fee from New business insurance contracts

*NoP* – number of policies

*average SI* – average sum insured

*risk factor* – the risk adjustment factor chosen for the purposes of calculating the risk adjustment, is calculated from the average sum insured per death.

## 4 RESULTS

In the following section, we will define a model portfolio and gradually demonstrate the VFA method according to IFRS 17. The selected portfolio consists of 80 unit-linked life insurance policies with an annual premium payment. The pay-out at endowment is the value of the fund, at death it is the maximum of the sum insured for death and the value of the fund. All insurance contracts have duration 20 years. The sum insured for death ranges from 360 € to 37 200 €. The

written premium starts from the amount 240 € and the highest amount is 3 600 € yearly. The following assumptions were selected for cash flow calculations, Variable fee - VF, underlying items, coverage units, CSM, RA and other values. In modelling the cash flows and the calculation was chosen lapse rate of insurance contracts and investment return for each year of the policy, shown in Table 3.

Tab. 2 – Selected assumptions for actuarial calculations. Source: own research

Premium allocation	96%
Management charge	2%
Surrender charge	20%
Expenses per policy	4%
Inflation	2%
Risk factor	0,03%
Expenses per policy in € for the entire portfolio	8,00
Expected claims in € for the entire portfolio	7 000,00
Actual expenses in € for the entire portfolio	2 000,00

Tab. 3 – Selected assumptions (lapse rate + investment return). Source: own research

Policy year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lapse rate in %	10,0	8,0	7,0	5,5	3,5	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Investment return in %	5,4	4,0	3,5	2,0	1,0	3,0	4,0	3,0	2,0	1,0	2,0	3,0	4,0	3,0	2,0	4,0	4,5	3,5	2,0	3,0

### Valuation of the insurance contracts using the VFA method

We quantified cash flow values. Charges consist of an allocation, surrender charge and a fund management charge. These are followed by costs, benefits payments and interest accretion. Present value of variable fee (*PVVF*) expresses the amount part of which the insurance company keeps for itself and the other part consists of fulfilment cash flows, that do not depend on the underlying items.

In table 4 is shown the development of *PVVF* for the first 2 years. Item new business are cash flows of insurance contracts at initial recognition. Subsequently, the expected *CF* and interest accretion are added and the resulting value is the *PVVF* at the end of the period.

*BoP* is the begin of period,

*EoP* is the end of period.

Tab. 4 – Development of present value of VF. Source: own research

Development of present value of variable fee		
<b><i>PVVF at BoP</i></b>	<b>0</b>	<b>147 296</b>
New business	142 289	0
Expected <i>CF</i>	-2 536	-4 208
less allocation charge	-2 150	-1 976
less surrender charge	0	-852
less management charge	-1 087	-2 005
plus outgo above fund	125	86
plus expenses	576	540
Interest accretion	7 542	5 800
<b><i>PVVF at EoP</i></b>	<b>147 296</b>	<b>148 888</b>

Coverage units - *CU* express real insurance coverage in case of death of all clients. We calculated their present value and discounted it at the chosen investment return.

Tab. 5 – Coverage units, *RA* and *CSM* for the first 2 years. Source: own research

<b>Coverage units</b>		
Coverage units	280 906	252 657
Present value of <i>CU</i>	6 239 293	6 277 757
Amortization factor	4,50%	4,02%
<b>Development of <i>RA</i></b>		
<b><i>RA</i> at <i>BoP</i></b>	<b>0</b>	<b>76</b>
New business	84	0
Release	-8	-6
<b><i>RA</i> at <i>EoP</i></b>	<b>76</b>	<b>70</b>
<b>Development of <i>CSM</i></b>		
<b><i>CSM</i> at <i>BoP</i></b>	<b>0</b>	<b>143 005</b>
New business	142 205	0
Interest accretion	7 542	5 800
Release	-6 742	-5 989
<b><i>CSM</i> at <i>EoP</i></b>	<b>143 005</b>	<b>142 817</b>

New business of *RA*, release and balance at the end of the period is shown in table 5. The development of *RA* for the entire insurance coverage is shown in figure 3.

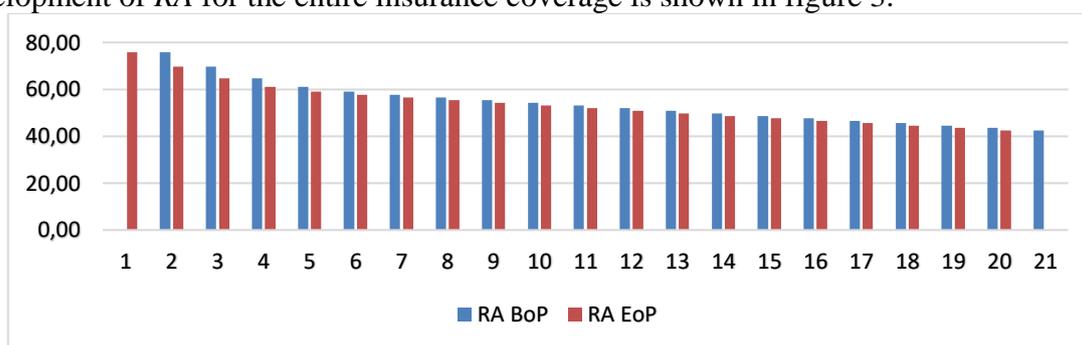


Fig. 3 – Development of *RA*. Source: own research

Creation of *CSM*, release and end-of-period balance are shown in table 5. *CSM* release depends on the percentage of amortization. The development of *CSM* is shown in figure 4.

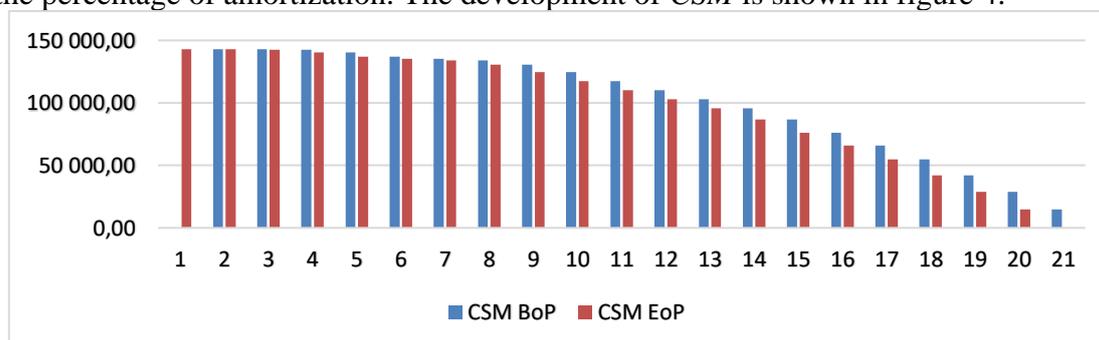


Fig. 4 – Development of *CSM*. Source: own research

*CSM* can only acquire positive values, if it acquires negative ones, it changes into a loss component (*LC*), which is immediately recognized in the income statement.

#### 4.1 Profit display

IFRS 17 completely changes the structure of financial statements: the balance sheet and the income statement. We present these two financial statements in the first 2 years. To compare data from previous years, the insurance company will have to apply retrospective valuation of all insurance contracts according to the methods of IFRS 17. If this is too impractical and

complicated, an insurance company may use the fair value approach or a modified retrospective approach. If different approaches are used at the transition date, we may achieve significantly different results, which in future accounting periods will affect the profit reported from the contracts in force at the transition date.

Tab. 6 – Balance sheet under IFRS 17. Source: own research

<b>Balance sheet under IFRS 17</b>	<b>1 year</b>	<b>2 year</b>
Unit-linked assets	53 236	98 200
Cash income	241	4 208
<b>Total assets</b>	<b>53 477</b>	<b>102 408</b>
<i>PV FCF</i>	- 94 060	- 50 688
<i>RA</i>	76	70
<i>CSM</i>	143 005	142 817
Total liability	<b>49 022</b>	<b>92 198</b>
<b>Own capital</b>	-	4 214
<b>Profit/Loss</b>	4 456	5 995
Total equity	4 456	10 209
Total liability + equity	<b>53 477</b>	<b>102 408</b>

Table 6 shows the balance sheet for the first two years, there are new values – RA, CSM and PV FCF – present value of fulfilment cash flows, which introduces IFRS 17. Table 7 shows income statement also for the first two years. The technical service result includes insurance income, CSM release, RA release, expected claims and expenses. The technical service result is the sum of insurance income and technical service expenses. Other comprehensive income includes the effect of discount rate changes on insurance liability. In our case is zero, because expected values equal incurred values

Tab. 7 – Income statement under IFRS 17. Source: own research

<b>Income statement under IFRS 17</b>	<b>1 year</b>	<b>2 year</b>
<b>1. Insurance service result</b>	<b>4 456</b>	<b>5 995</b>
1.1. Insurance revenue	13 456	14 387
<i>CSM</i> release	6 742	5 989
<i>RA</i> release	8	6
Expected claims	6 129	7 852
Expected expenses	576	540
1.2. Insurance service expenses	- 9 000	- 8 392
Incurring claims	- 7 000	- 7 852
Qualifying non-deferrable expenses paid	- 2 000	- 540
<b>2. Insurance finance income and expenses</b>	<b>-</b>	<b>0</b>
Net investment result on unit-linked investments	2 765	3 856
<i>CSM</i> interest	- 7 542	- 5 800
Interest accretion on <i>PVFCF</i>	4 777	1 944
<b>Profit and Loss</b>	<b>4 456</b>	<b>5 995</b>
Other comprehensive income	-	-
<b>Total comprehensive income</b>	<b>4 456</b>	<b>5 995</b>

Figure 5 shows the expected profit for the entire insurance period of the selected portfolio under both IFRS 17 and IFRS 4. We see an increase in profit, slowly and evenly, and this is the goal of IFRS 17 so that the insurance company did not impute profit from insurance contracts now, but evenly amortizes it throughout the period of insurance coverage. Profit according to IFRS 4 is lower at the beginning, in the following years until the end it is always higher than IFRS 17.

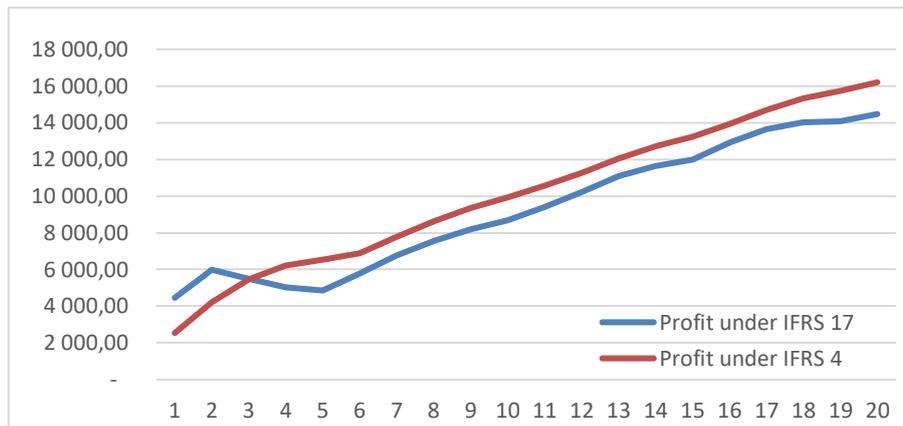


Fig. 5 – Profit development under IFRS 17 and IFRS 4. Source: own research

## 5 DISCUSSION

The VFA method is compulsorily applicable to investment contracts with DPF (direct participation feature) including also unit-linked products. Standard IFRS 17 requires a direct link between the profit sharing and the fair value of the underlying items. In the paper author quantifies cash flows, underlying items, present value of variable fee, contractual service margin, risk adjustment and in the end expected profit. The selected portfolio turned out to be profitable, which author also proves by the presentation of financial statements prepared in accordance with the requirements of IFRS 17. The balance sheet and the income statement in the new structure are presented in the end of actuarial calculations of the VFA method. Thus, IFRS 17 is principle based, therefore it does not contain precise calculations for the new values which it introduces. It is up to insurance company which calculation methods they choose, e.g. to calculate risk adjustment or contractual service margin.

However, in other jurisdictions, particularly in the European Union where the Cost of Capital has become a standard for estimating the Solvency II Risk Margin, this disclosure can present a significant difficulty for companies who do not have an internal model providing the full Reserve risk distribution. It should particularly be the case for companies using the Solvency II standard model, which provides limited information in relation to the underlying risk distributions (Chevallier, Moro, Krvavych, Rudenko, 2018).

Under IFRS 17, insurance companies will be required to update their assumptions on a regular basis – including the discount rates used to estimate liabilities in individual reporting periods. The insurer will thus provide the public with the most up-to-date overview of liabilities from insurance activities and its financial situation. This step represents a change from the current situation where entities, reporting under IFRS 4, use a fixed interest rate. In the event that there are changes in actuarial assumptions due to a different development of actuarial assumptions than expected, then unexpected effects on the total comprehensive income of insurance companies are created. If a loss occurs that is higher than the unearned contractual service margin, it is recognized immediately.

## 6 CONCLUSION

The paper was devoted to the actual topic of the insurance sector. Insurance companies will have to disclose information of the amounts, judgments and risks arising from insurance contracts. The disclosure requirements are more detailed than originally required by IFRS 4. The main objective of IFRS 17 is to identify, in particular, profitable and onerous insurance contracts and to indicate the development trend of the insurance contracts. Another objective

of the standard is to spread the insurance company's profit over several time periods to follow the insurance coverage. Under IFRS 4, the profit might not be reported in the years of its actual origin. Actuarial assumptions in provisions under IFRS 4 are also not updated based on latest experience. These reasons have led to the emergence of a new standard to ensure better comparability of data about the profitability of individual insurance companies at the same time.

On the other hand, IFRS 17 also brings huge implementation cost, the increase in fixed costs as more actuaries and financial experts are needed only to deal with a new standard and lots of time for preparation for all insurance companies. For smaller insurance companies this might be a significant burden to deal with questionable added value to their simpler and smaller portfolios.

The European Insurance CFO Forum and EFRAG (European Financial Reporting Advisory Group) have addressed for 2 years to IASB many amendments. They required an effective date 1.1.2023 and it was accepted. Another amendment was that *CSM* should be calculated according current rate (not locked-in rate) same as the value best estimate of liabilities (BEL). In June 2020 was issued a new version of standard IFRS 17. Accepted amendments describes e.g. (KPMG, 2020). Is it really worth investing so much in changing information systems, new accounting rules, new actuarial calculations for a better overview of the profitability of insurance contracts, amortization of profit and the search for onerous insurance contracts? We will see after 2023.

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# A WIDER FUTURE RESEARCH AGENDA AND RESEARCH GAPS IN THE CONTEXT OF INDUSTRY 4.0, WITH THE FOCUS ON MANAGEMENT ISSUES

*Najam Ul Zia, Aydan Huseynova*

## **Abstract**

Industry 4.0 is all about computerization and digitization of processes through the use of cyber physical systems (CPS), Internet of things (IOTs), and big data. This strategy offers an advanced level of resource usage to regulate the production systems and ensure mass customization at low cost. This study presents a broader future research agenda in the context of Industry 4.0, with the focus on management perspective. It highlights the research gaps based on the review of literature, and suggests future research areas by integrating the logical beliefs with the literature. Search for the key word “Industry 4.0” results in 7476 items only till 2017 from Web of Science and Scopus. From 2018 to 2020 there are more than 16450 studies published on the topic of Industry 4.0 in the mentioned databases. This study conducts the review of literature and highlights few important but ignored areas of research on Industry 4.0, with the focus on management issues. There is sufficient literature available on the technological aspects of Industry 4.0 but studies on management issues are rare.

**Keywords:** *Industry 4.0, Organizational ambidexterity, Management approaches, Technological transformation, HR practices*

## **1 INTRODUCTION**

The recent trends in technology and the thirst of innovation, the industries have faced several paradigm shifts, and these are known as industrial revolutions (Lee, Kao, & Yang, 2014). It creates digitalized manufacturing companies (Weking et al., 2020). As shown in fig 1, first industrial revolutions had undergone mechanization processes; second industrial revolution was all about production under high electrical usage whereas third industrial revolution was characterized by electronics and automation (Ramakrishna et al., 2020). The world’s economy of today is moving towards the fourth industrial revolution where several industrial problems are solved by the use of digital transformation, Cyber Physical Systems (CPS), service innovation and smart factories (Heng, 2014; Shamim et al., 2016). This 4th industrial revolution is also known as Industry 4.0 (Burmeister, Lüttgens, & Piller, 2016), which characterizes the current businesses and processes with digital transformation and converting the manual work with digital structures with the help of Cyber Physical Systems (CPS) and Internet of Things (IOTs) (Iansiti & Lakhani, 2014). Data is the key element in this strategy which is used to enhance the business process (Mehrfeld, 2019).

The idea for Industry 4.0 was firstly introduced by Germany and that is playing an important role in developing this next paradigm shift (Shamim, Cang, & Yu, 2016). This concept was originated from a project of German government and its purpose was to promote computerization and digitization. There is an expectation that the implementation of the Industry 4.0 strategy will boost the German economy up to 267 billion euro (Heng, 2014). This concept is not only useful for Germany; in fact, Industry 4.0 has becoming a strong strategy for the fourth industrial revolution and it has been discussed by several researchers in different economies and contexts, e.g., (Wang et al., 2016).

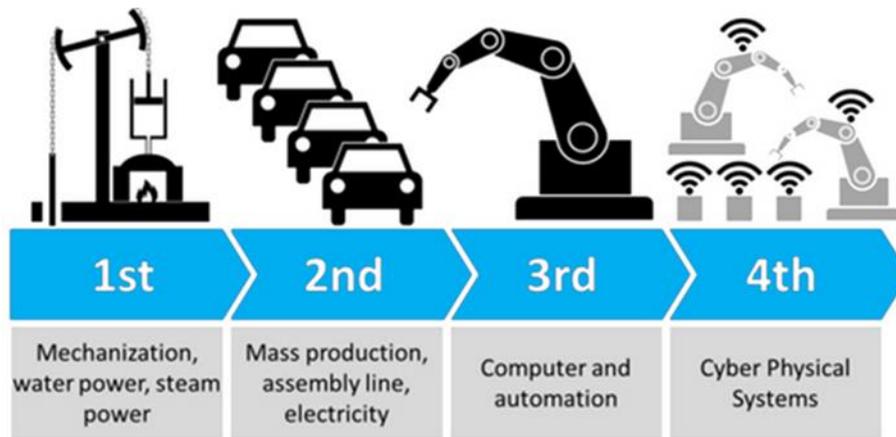


Fig. 1 – Industrial Revolutions. Source: O’Donovan et al. (2018)

Industry 4.0 is considered by the application of cyber physical systems, smart production, digital enhancements, and the use of big data (Heng, 2014; Shamim et al., 2017). Industry 4.0 is triggered by main political, economic, technological and social deviations (Heng, 2014). Business of current era face many challenges like, mass customization at low cost, supply chain efficiency, required timely information about needs and wants of customers, smart working environment and perfect combination of products and services (Iansiti & Lakhani, 2014). Industry 4.0 strategies is required for flexible processes and high efficiency of the supply chain structures. Moreover, the better products management, production just in time and efficient time to market, they all need Industry 4.0 to implement in the business (Iansiti & Lakhani, 2014).

Review of literature reveals number of research gaps in the context of Industry 4.0. Specially there is need to investigate the Industry 4.0 in management science perspective. Current academic research on Industry 4.0 mainly addresses the technological developments (Weking et al., 2020) i.e. development of CPS, Internet of Things (IOTs), and engineering designs for Industry 4.0 (Heng, 2014; Saldivar et al., 2016; Shamim et al., 2016). It is still untapped that up to what extent, and which type of companies are adapting the strategy of Industry 4.0, and what are the factors influencing the adaptation of Industry 4.0 concept in EU and also in other regions. Furthermore, there is need to evaluate the effectiveness of Industry 4.0 concept against its predefined challenges i.e. supply chain effectiveness and efficiency, mass customization at low cost, and timely information of customer needs and wants. Another research gap is to test the consequences of applying Industry 4.0 i.e. competitiveness, financial performance, innovative capability, and readiness for revolutionary change. Along with research on technological developments, managerial issues are also important to investigate (Dregger et al., 2016; Shamim et al., 2017).

The main objectives of the study are to highlight the research gaps regarding implementations of Industry 4.0, evaluation of Industry 4.0 against pre-defined challenges, exploring the factors affecting the implementation of Industry 4.0, examining the suitable people management approaches, examining the socio technical in Industry 4.0 context, organization ambidexterity and technological transfer. On the basis of literature review and logical beliefs, this study highlights the research gaps and potential future research agendas in the context of management issues for Industry 4.0.

## **2 THEORETICAL BACKGROUND**

### **Industry 4.0**

The industry is a very important pillar of any growing economy. Many industries faced different types of changes in technology and innovations (Shamim et al., 2017; Shamim et al., 2019), and these are paradigm moves which are called “Industrial revolutions”. The first industrial revolution is characterized as “mechanization” and it came with using of steam power, the second industrial revolution is referred to high usage of electrical energy and the third one is electronics and automation computers. The fourth industrial revolution is a key requirement for today’s growing economies and it comes with the internet of things, cyber-physical systems, and networks (Lasi et al., 2014). This is triggered by social, technological, economic and political changes. This 4th industrial revolution is also called as Ind 4.0 (Burmeister, Lüttgens, & Piller, 2016), which represents as digital transformation in current business and existing processes, and changing the manual working methodologies with digital computer structures (Iansiti & Lakhani, 2014).

### **Need to empirically measure the implementation of Industry 4.0**

Undoubtedly, Industry 4.0 is a high budget program, and the expectations are also very high (Heng, 2014). Researchers have considerably investigated technological requirements of Industry 4.0, and it is still in the implementation phase. However, at this level of implementation it is rationale to measure the level of implementation of Industry 4.0 strategy. This measurement should be based on the predefined key inputs of Industry 4.0, which are implementation of CPS, excessive use of big data, smartness in product/services, and digital transformations. These factors can be measure by adopting, adapting, and developing the items and questionnaire for quantitative data analysis. It should be followed by quantitative analysis for validity, reliability, and to measure the level of implementation at firm level, using the Likert scale. It is recommended to measure the evaluation in EU, particularly using the sample of German firms, as Europe is the origin of Industry 4.0. This measurement will reveal the level of interest and acceptant of Industry 4.0 concept in European firms. Existing literature does not examine the level of implementation of Industry 4.0 which is still a potential future research area and research gap in the existing literature.

### **Need to empirically evaluate Industry 4.0 against predefined challenges**

After empirically measuring the implementation level of Industry 4.0, next step should be the evaluation of Industry 4.0 against its predefined challenges. Main challenges of Industry 4.0 are supply chain effectiveness and efficiency, cost effectiveness and mass customization at the same time, timely information. The prime goals of Industry 4.0 strategy are to provide innovative business models in the value chain; to make smart factories that are enables with IOT production; to apply a paradigm that is human-machine friendly; to generate communication among products, parts, and machines; to monitor products and parts; to ensure an automatic and flexible production chain; and to provide mass customization of products with the help of IT enabled tools (Masood & Sonntag, 2020). Furthermore Industry 4.0 is expected to enhance the firm readiness of revolutionary change, performance, innovative capability, and competitiveness. Companies desire to be mature in Industry 4.0 readiness but show little maturity level when checked for Industry 4.0 implementation (Antonsson, 2017). These consequences should also be investigated as outcomes of Industry 4.0 implementation. In other words, there is need to investigate the impact of implementing CPS, excessive use of big data, smart production, and digital transformations on supply chain effectiveness and efficiency, timely information, and mass customization at low cost, which can lead to competitiveness,

innovative capability, financial performance, and readiness for revolutionary change at firm level. The phenomenon is presented in figure 2.

### Need to explore the factors affecting the implementation of Industry 4.0

Measurement of the level of implementation of Industry 4.0 at firm level will identify the firms, which are fully, partially, or not implementing the strategy of Industry 4.0. Initially, there are certain priority areas to that are important to implement Industry 4.0 strategy, like, to highlight weak spots and strengthen them; problems solutions as per available resources; ensuring infrastructure delivery to this industrial transition and regulating factors concerning for safety and security (Oztemel & Gursev, 2020). The companies, which are implementing the strategy of Industry 4.0, can be used for qualitative exploration of the enablers of the Industry 4.0 implementation. The companies not implementing the concept of Industry 4.0, or partially implementing it, as identified in quantitative measurement of Industry 4.0 implementation, can be used to explore the barrier of its implementation. Existing literature does not cover the factors influencing the strategy of Industry 4.0, which strongly justifies the need to qualitative exploration of factors affecting the implementation of Industry 4.0.

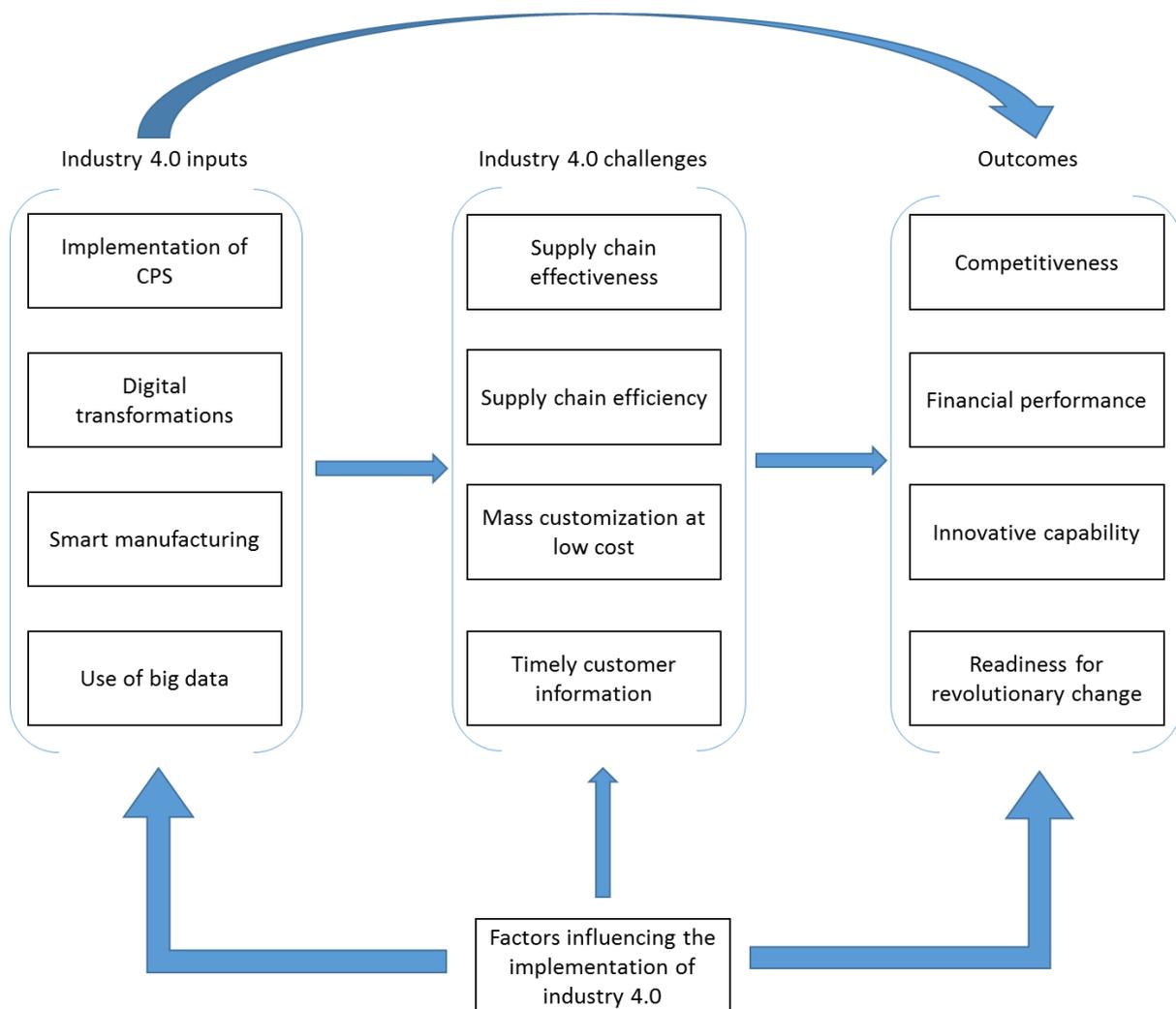


Fig. 2 – Conceptual model for the evaluation of Industry 4.0 against challenges. Source: own research

### Need to examine the suitable people management approaches

Main focus of the researchers in the context of Industry 4.0 is on the technological aspects, particularly engineering designs (Shamim et al., 2017). However, another challenge that has received little attention is the development, training, and the management of people according to the Industry 4.0 environment and requirements i.e. there is need to address the questions such as what kind of skills would be more useful in Industry 4.0, what kind of human resource (HR) management practices are compatible, what kind of trainings, leadership, organizational structures, knowledge management techniques, what kind of employee attitudes and behaviours, what kind of education etc. as input is required for Industry 4.0. Another needed research area in the context of Industry 4.0 is the impact of implementing Industry 4.0 on workforce. For example, job design, change in career preferences, new motivational factors, skill development, work life balance, change in compensation criteria etc. There is need to consider the social aspects as well along with the technological aspects of business (Dregger et al., 2016). The only study available on people management perspective in the context of Industry 4.0 is a conceptual study of Shamim et al. (2016), which suggest the validation of the model shown in figure 2. Shamim et al. (2016) suggest the investigation of organizational structures, knowledge-oriented leadership, HR practices, and willingness to abandon investment and knowledge and focus on short innovation and long-term capabilities as influencers of learning and innovation, which leads to compatibility with Industry 4.0 environment.

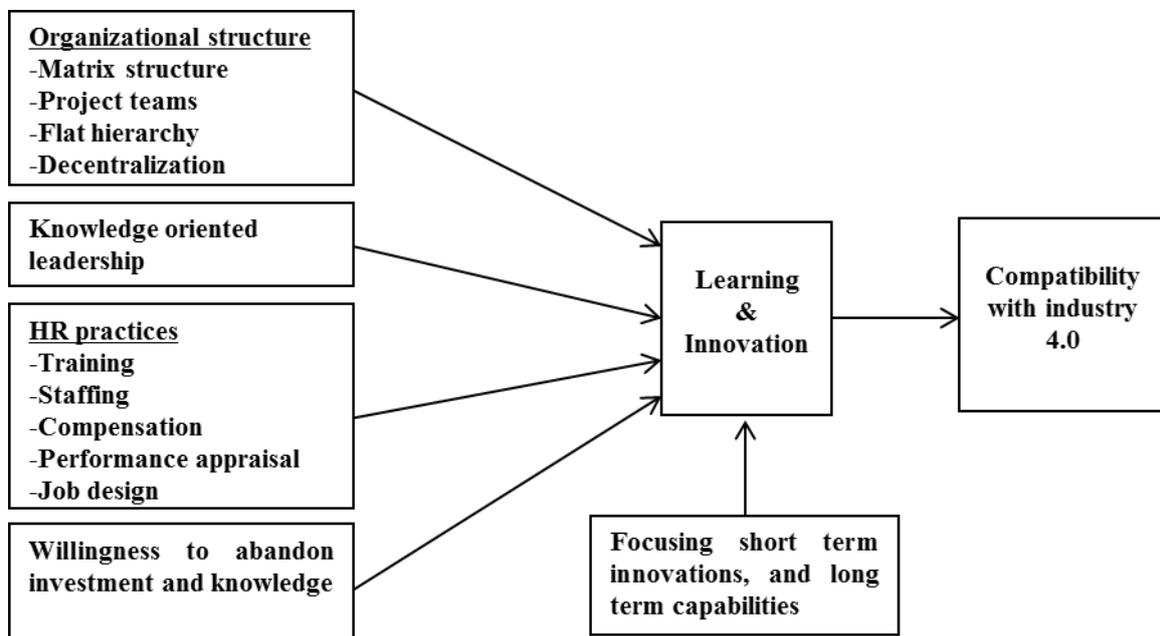


Fig. 3 – Management practices for Industry 4.0, a future research framework. Source: Shamim et al. (2016)

Shamim et al. (2016) also explain the whole process in the broader perspective. Management approaches should facilitate learning, knowledge management, and people capability, which lead to innovations smart business processes, and ultimately to compatibility with Industry 4.0. However, there is need to validate the suggestions and arguments of Shamim et al. (2016) using the quantitative validation methods.

### Need to examine the socio technical in Industry 4.0 context

Industry 4.0 will bring the technological transformation, which affects the employees and organization in several ways (Hofmann & Rüsçh, 2017). These transformations can affect the work environment (Shamim et al., 2016). There is need to investigate the interaction of

technology, human, and organization in the context of Industry 4.0. This investigation should discover the impact of technological transformation on human behaviours and work outcomes. It should also explore the way technological transformations change the organizational work inputs and outputs. Existing literature lacks the investigation of these interactions.

### **Industry 4.0 and organizational ambidexterity**

Industry 4.0 has the potential of enabling the organization for dual innovation strategy (Kagermann, 2015). Implementation of CPS, smart processes, and especially the use of big data can enhance the information efficiency of organization (Janssen, van der Voort, & Wahyudi, 2017). It is also found in existing literature that researchers are suggesting the mechanisms for the automatic mass customer feedback to link it with production processes (Saldivar et al., 2016). Use of big data can also enable the organization to create knowledge (Khan & Vorley, 2017). Inputs of Industry 4.0 i.e. smart processes, big data use, CPS, and digital transformation can facilitate the knowledge management in the organization. Knowledge management consist of both exploitative and exploratory activities i.e. creation, acquisition, storing and applying knowledge (Shamim, Cang, & Yu, 2016), which can lead to innovativeness at both individual and organization level. It enables the organization to get advantage of existing resources and also enables to explore the new methods of creating value. Existing research in the context of Industry 4.0 does not discuss the ways that Industry 4.0 can enable the organization to be ready for both incremental and radical change, which is a potential future research area.

### **Need to explore the process and consequences of transfer of Industry 4.0 strategy from European firms to partner firms in other regions**

Origin of Industry 4.0 is Germany (Schweer & Sahl, 2017), but it does not mean that is limited to Germany or Europe. It is getting considerable acceptance in other regions as well (Wang et al., 2016). It would be interesting and worthwhile to investigate the factors influencing the acceptance of Industry 4.0 in other regions. Especially in case of firms working with European partners, the process and consequences of transfer of Industry 4.0-strategy form European firm to partner firms in other regions should be examined. Existing literature does not inform about this important issue, which needs further research.

### **Need to address the service sector**

Majority of the studies in the context of Industry 4.0 are discussing the manufacturing sector e.g. (Bassi, 2017; Kuo, Ting, & Chen, 2017; Majeed & Rupasinghe, 2017). Very few studies discuss the service sector in the context of Industry 4.0 e.g. (Shamim et al., 2017). Digitization and technological transformations are also relevant to the service sector (Decker, Fischer, & Ott, 2017; Schmidt, Drews, & Schirmer, 2017). The suggested challenges for Industry 4.0 i.e. supply chain effectiveness and efficiency, mass customization at low cost, and timely information are also the challenges for service organizations (Shamim et al., 2017). The scarcity of research on Industry 4.0 in the context of service sector urges the need of future research in this area.

## **3 METHODOLOGY**

As Industry 4.0 is an infancy topic, there is significant research conducted and published after the introduction of this topic in the year 2011. Majority of the research is undertaken on the evaluation of technologies related to Industry 4.0 (Liao et al., 2017; Schneider, 2018). In the meanwhile, a number of studies started to conduct on the topic of implementation of Industry 4.0. There are numerous studies that why organizations become agree or disagree in its

adaptation. There is a need of clarity in order to build a solid platform for policy makers, practitioners and scientists to make effective policies and strategies. In this scenario, the brief literature review offers the important toolkit to address this problem by evaluating the finding and bringing together of all relevant sources. Moreover, the process of analysing, selecting and identifying relevant resources also supports to reveal potential gaps that need to be discussed and addressed in future researches (Ressing, Blettner, & Klug, 2009). Therefore, it is not important that either other areas of Industry 4.0 have been discussed and covered with a brief literature review such as the study of Buer, Strandhagen and Chan (2018), who investigated the link between manufacturing and Industry 4.0. Although numerous studies have used the systematic literature method in Industry 4.0 context, there are rare studies that have explored the challenges and factors important in implementing this strategy.

The main objectives of the study are to highlight the research gaps regarding implementations of Industry 4.0, evaluation of Industry 4.0 against pre-defined challenges, exploring the factors affecting the implementation of Industry 4.0, examining the suitable people management approaches, examining the socio technical in Industry 4.0 context, organization ambidexterity and technological transfer. It highlights the research gaps based on the review of literature, and suggests future research areas by integrating the logical beliefs with the literature. Search for the key word "Industry 4.0" results in 7476 items only till 2017 from Web of Science and Scopus. From 2018 to 2020 there are more than 16450 studies published on the topic of Industry 4.0 in the mentioned databases. This study conducts the review of literature and highlights few important but ignored areas of research on Industry 4.0, with the focus on management issues.

We used the term "Industry 4.0" in finding the relevant literature that was addressing management perspective. Though, there were more research papers present in other data bases but in this review, we selected those research papers which were published in journals with high quartile and article impact score. We selected these articles published during the last six years (2014 to 2020) from Web of Science and Scopus and referenced accordingly. We highlighted the key research gaps regarding implementations of Industry 4.0, evaluation of Industry 4.0 against pre-defined challenges, exploring the factors affecting the implementation of Industry 4.0, examining the suitable people management approaches, examining the socio technical in Industry 4.0 context, organization ambidexterity and technological transfer and suggested future research directions accordingly.

#### **4 DISCUSSION & CONCLUSION**

Research on Industry 4.0 is increasing rapidly. Search for the key word "Industry 4.0" results in 7476 items only till 2017 from Web of Science and Scopus. From 2018 to 2020 there are more than 16450 studies published on the topic of Industry 4.0 in the mentioned databases. This study conducts the review of literature and highlights few important but ignored areas of research on Industry 4.0, with the focus on management issues. There is sufficient literature available on the technological aspects of Industry 4.0 but studies on management issues are few.

This study will open the new directions for the future research. It provides a rich framework for the future researchers investigating the issues of Industry 4.0. Especially it will increase the focus of the researchers on the social challenges of Industry 4.0. Investigation of these issues has the potential of improving work outcomes by enhancing the work environment. For example, by investigating the right match of management practices, employee, organizational design, and technologies, managers can enhance the person organization fit, job satisfaction, and motivation etc. measurement and evaluation of Industry 4.0 against set objectives that will tell the policy makers that up to what extent the investment on Industry 4.0 is justifies, based

on its performance to deal with predefined challenges. Exploration of factors influencing the implementation of Industry 4.0 will facilitate the managers and policy makers to implement the Industry 4.0 by highlighting important factors for its implementation at individual firm level. By investigating the process and consequences of transfer of Industry 4.0 its generalizability can also be evaluated.

This study also suggests checking the Industry 4.0 readiness level of the firms by doing quantitative survey of the companies. Knowing the Industry 4.0 readiness level of the firms is an important step to strategically start this new paradigm. It recommends to empirically evaluating Industry 4.0 against predefined challenges. This study highlights the need to explore factors that may affect implementation of Industry 4.0 strategy. It also articulates to examine suitable people management approaches and socio technical perspective in Industry 4.0 context. Moreover, it suggests conducting research on service sector as well because, so far, only manufacturing is addressed in numerous parts of literature. It proposes to explore the process and consequences of technological transfer from European firms to Asian partner firms in other regions. The exploration of the process of transfer of Industry 4.0 strategy will facilitate the process of knowledge and learning which plays a key role for organizational compatibility with Industry 4.0 strategy (Shamim et al., 2016).

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# CONCEPT OF THE DEVELOPMENT OF AN IMPLICABLE TOOL FOR DECISION MAKING IN THE RISK MANAGEMENT PROCESS

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## **Abstract**

The purpose of this article is to provide a tool to assist in decision-making in particular those with risks. The work is descriptive in form and is conceptual in nature. It presents in the light of the literature the approach to risk management, its structural structure, techniques and tools used for risk management. The methodology used in this article is based on a qualitative method and focuses on trying to find and fill a risk management gap by developing a tool to facilitate decision making. The tool developed in its concept is intended to help in this important and relevant process, which concerns not only the discipline of risk management but also any other sphere of human life that requires responsibility for the decisions taken. Selected tool methods and techniques used in risk management are presented. The rationale and guiding idea of this article is to present a tool developed in a conceptual form to help in making decisions resulting from an emerging risk. The paper tries to present the decision-making tool "ADT" (analysis of decisions taken). The principle of its operation, the scheme of conduct, analysis and assessment of the validity of the decision taken in the risk assessment. A diagram of actions that can be used to choose the most beneficial option for the implemented plan is presented in the risk management element. In its concept, the article presents a tool that can be used in decision making, outlines the importance of this in risk management.

*Keywords: risk, management, risk analysis tools, decision making analysis, decision-making methods*

## **1 INTRODUCTION**

Nowadays, every undertaking which is exposed to incur costs resulting from specific activities is anointed with risk as an inseparable element of the implementation of undertaken activities. A proper risk assessment eliminates to a minimum the risks that may occur and appear as a result of activities. It gives a forecast of expected losses as a result of conducted activities, raising awareness of possible inconveniences and irreversible, negative effects of undertaken actions. Appropriate selection of tools and techniques and their skilful use allows to avoid or even completely eliminate the threats related to the activity. Proper identification of possible risks, proper analysis of the significance of the risk for the organization's activity, selection of appropriate, implied methods to protect against factors causing risk, by monitoring and controlling deviations from the planned assumptions and taking preventive actions, is already risk management. It is impossible to operate an organization without taking risks and without taking responsibility for those risks, which undoubtedly translates into the success of the implemented projects. The ability to manage risk, which is an unavoidable phenomenon in running a business, gives an advantage over what the organization can gain by minimizing the generated losses.

The constantly evolving environment forces the organisation to make constant changes in management, which is the reason for the increase in risk and the emergence of new sources of risk. New technologies and their rapid development form the basis on which risks are created for business. That is why it is very important to manage risk skilfully by selecting the right tools and techniques, models and systems for proper planning, for proper and reliable analysis, for

control with corrective elements to reduce the risk level as much as possible. Risk management is designed to anticipate the factors that create this risk and which are responsible for it.

The main reason and motivating factor for writing an article is the need to pay attention to the decision-making process and to create a tool that will make the process easier and the result of the decision-making activities more beneficial and the risk is reduced. The motivator for committing an article is the need to share knowledge that will facilitate the decision-making process in practice. The article is a qualitative research work and its concept assumes applied research. The paper deals with practical aspects of risk management in the context of decision-making. The research refers to practical applications of tools, techniques and models used in risk management and decision making. An important element is the presentation of a new tool that helps to make decisions and to choose the best and most appropriate solutions for the considerations.

Every company strives to gain a competitive advantage and risk is the factor that has a negative impact on the organization's supplements. That is why it is so important to manage it properly and skilfully and to be aware of the risks that are inextricably linked with activities where costs and capital expenditure are incurred. Well defined and controlled risk is also a stimulus to search for new solutions and innovative ideas for the organization. Awareness of the existence of risk and dealing with it in e-business organizations contributes to the success and future supremacy of the company.

## **2 RISK MANAGEMENT IN ONLINE BUSINESSES**

### **The concept and role of risk management in an online business**

At the outset, it is worth trying to define what risk is. Samuelson (2009) believes that risk is a form of uncertainty that we deal with when a decision has more than one possible outcome. He tries to point out that if the results of studies or analyses are more difficult to interpret the degree of uncertainty is higher and thus the risk is higher. If there is a situation as a result of which it is known what may happen and what is the probability of such an event, such a situation is undoubtedly combined with risk, as Stabryła (2010) notes

It can be understood that any decision-making project that raises the uncertainty of the future facts brings with it the uncertainty of what will happen in the future, and the risk taken is the decision state in which responsibility for this uncertainty is assumed. As you can read, the ability to deal with the risk by choosing the best possible solutions is a difficult, labour-intensive and very important task for the manager in the organization. Risk management can be called a form of action that has been aimed at minimizing or completely eliminating the effects of emerging risks in the organization's areas of activity and, what is more important, looking for development opportunities thanks to undertakings in the area of increased risk (Romanowska & Trocki, 2004). Implementation of developed strategies aimed at improving the relationship between the risk itself and the expectations resulting from the project plan and the outlays to be incurred during the implementation of activities (Kaczmarek, 2010). Chrapko (2010) drew attention to the emerging problems which are the reason for the emerging risk. Identifying problems before they appear and including them in the whole project life plan will contribute to mitigate the achievement of the organization's goals.

Risk is present in all activities of an organization where the main element is the decision-making factor and costs and expenses for the planned activity are incurred. Risk management aims at influencing the planned activity in such a way as to eliminate as much as possible the risk from specific, performed activities. The role of risk management is undoubtedly the process of making such decisions that will eliminate the dangers that arise during the implementation of

specific activities. Anticipating and preventing critical situations in which the engagement of the undertaking may find itself. Therefore, a very important element in risk management is a detailed control of the entire project process at each stage. Starting from planning, where an important element is predicting the occurrence of potential risks, defining their effects and causes, through the process of implementation and execution, undertaking a wide range of analyses, up to the moment of control, monitoring reactions to specific activities, responding to the results of instruments and tools for checking the correctness of actions.

### **Risk management models in e-business**

Risk management in an organisation is related to management accounting. This view is presented by Klinowski (2010), who points out that based on PMBOK methodology, risk management consists of six processes. These processes are cyclically repeated during the implementation of the project activities. It consists of the following elements: (a) Risk Management Planning; (b) Risk Identification; (c) Qualitative Risk Analysis; (d) Quantitative Risk Analysis; (e) Risk Response Planning; and (f) Risk Monitoring and Control (Klinowski, 2010).

The elements presented above relate mainly to risk management during the preparation and implementation of specific projects in the organisation. Risk management planning includes in its idea reduction or complete elimination of threats and preparation of corrective actions, arising problems that may contribute to the failure to achieve the intended objectives. At the planning stage key elements should be considered: (a) selection of methodology including tools and techniques to be used during the analysis; (b) appropriate selection of teams and allocation of relevant functions to staff; (c) the determination of the budget for the implementation of the project; (d) the establishment of time frames and deadlines for the implementation of the intended activities; (e) development of a system for control, evaluation and follow-up of events resulting from the implementation of the actions; (f) forecasting scenarios and defining risk acceptance thresholds for them; and (g) preparing standardisation for documentation.

The next step is to identify the sources of risk-creation and determine the significance in a hierarchy according to accepted standards during the planning and implementation of the project. The main values to be followed when defining risks are: (a) risk management plan; (b) results arising from the implementation of project processes and activities; (c) defining risk groups and determining the importance of the project; (d) data from experience and knowledge; (e) analysis of environmental data and the organisation's environment; and (f) data resulting from the control of techniques and tools used.

A qualitative risk analysis consists in determining the possibility of the probability of a defined risk occurring and the effects it may cause. At this stage, tools and techniques are used to provide information and to make the right decisions. These include, among others: (a) trend forecasting; (b) development of scenarios; and (c) cause-effect analyses. The sources from which information and data for confrontations and statements will be drawn are very important.

An important phase in the risk management process is to respond to emerging risks. Such actions can be planned by anticipating the possibility of risk with its effects and causes. Depending on the type and nature of the risk, different methods are used to plan the management of that risk. These methods rely on: (a) risk avoidance; (b) transferring the risk to another entity; (c) reducing the level of probability and effect of risk; (d) agreeing on the consequences of the risk; and (e) creating alternative solutions.

Risk monitoring and control is the most important phase in the risk management process. It starts with implementation and relies on them to establish monitoring, analysing and observing and drawing conclusions. It consists of ensuring that all activities are carried out according to

plan and reacting in moment when irregularities and nonconformities occur. After the monitoring, the following measurements are carried out (Górecki, 2018): (a) whether the risk response strategies have been implemented according to plan; (b) whether the results assumed for the planned activities have been achieved; (c) whether the assumptions in the project plan are still valid; (d) whether the level and rank of a given risk has not changed; (e) whether risk activating sources have been created; and (f) whether new risks not defined in the previous steps have arisen.

The risk management process is very well illustrated by the ISO 31000 structure, which was published by the ISO International Committee for Standardization in 2009. It is a systemized structure of the risk management process addressed to entities and organization and does not constitute a basis for certification. The main principles and guidelines of risk management are: (a) Creation and protection of value; (b) Integration of risk management into all organisational processes; (c) Awareness that risk management is essential in decision-making processes; (d) Awareness that risk management is a form of uncertainty and a way of addressing it; (e) Risk management is a process defined by structure, systematics and time; (f) Properly adjusting the risk management process to the requirements, activities of the organization; (g) Planned effects result from an appropriate selection of resources and factors; (h) Transparency at each stage of risk management; (i) Dynamics resulting from responding and correcting the risk management process; (j) Proper risk management influences the improvement and development of the organisation. (Malon, 2018)

The risk management process is regulated in detail: (a) communication and exchange of information within the risk management process; (b) determining the value and importance of risk management; (c) establishing the risk formula and criteria; (d) identifying, analysing and assessing the significance of a specific risk; (e) developing a strategy for risk; (f) developing a plan of action for targeted risks; (g) monitoring and control of risk actions; (h) keeping full documentation of the entire risk management process.

An additional element is the introduction of ISO 31010, risk management, risk assessment techniques. It contains the preferred tools, techniques and methods of risk assessment (Malon, 2018). It follows that the price of risk during the implementation of a project should be considered when planning a specific activity in the organization and performed at each stage of the planned activity in an efficient, effective and efficient manner. Risk assessment focuses on three important phases: (1) Initial - Preparatory-initial - is based on planning and predicting the possibility of risk occurrence, on its possible occurrence within a certain period of time of a certain magnitude of impact, under the influence of the factors of the environment. (2) Realistic - Implementation-implementation - emerging threat causing a risk not foreseen at the planning stage, or implementation of certain assumptions assumes a pessimistic option. This requires a quick reaction and correction of actions. (3) Secondary - Checklist-ensure and confirm that the risks taken to the activity do not generate additional costs or unforeseen losses.

This form contributes to more efficient risk management, proper analysis and assessment of risk, faster response to nonconformities during implementation and effective assurance that planned projects are carried out in an effective, efficient and consistent manner.

### **Tools used in risk management in e-business organisations**

The first step in risk management is the appropriate and proper identification of that risk. Defining a risk is a significant step because its proper identification has a key impact on the subsequent success of planned projects. Risk identification is understood as all sources of impact (activities, phenomena, factors), which have an impact on the course of implementation of the assumed objectives of the project.

One such tool is the scenario method. It consists in defining possible phenomena and presenting in a logical way the consequences that can be caused by these phenomena while determining the possibilities of their development. Scenarios of possible probability, development of a phenomenon as a logical and chronological course of events are prepared. Such a scenario should consist of the following stages (Lisiński, 2004): (1) determination of the scope of analyses; (2) definition of factors influencing the results of strategic decisions; (3) determining what external forces will influence the course of the process; (4) preparing and developing activities of a logically related scenario; (5) analysis of the resulting effects of the actions; (6) analyse the decisions resulting from the effects of the actions taken.

Another tool to determine the possibility of risk is Open Space - Technology. Its assumptions are based on the form of three-day meetings involving a significant number of people involved in the subject. The deliberations are divided into three stages over three days as follows (Mikula, 2006): (1) day one - the problem under examination is identified and task forces are commissioned to work; (2) day two - a plenary session is organised where the task forces involved present the results of the joint activities, present their ideas for solving the problems. Discussions are held, questions are asked and answered. Then a report of the meeting is created in which proposals for solving the problem are presented; (3) day three - a final report is presented which sets out the solution to the problem.

Risk analysis in the process of risk management requires looking at potential threats as an emerging problem to be addressed and prevented from progressing. This can be done using FMEA (Failure Mode and Effects Analysis). It consists in analysing possible errors considering their consequences. The aim of this analysis is to determine the reasons for the deterioration of quality level in relation to products or processes in the organization. Drawn conclusions influence the decision-making process about actions taken to eliminate the adverse effect FMEA analysis requires the following actions (Karaszewski, 2006): (1) identify and define all elements of the process or product; (2) on the basis of the defined elements, making a list of possible errors; (3) drawing up a list of effects that may cause possible errors; (4) determining the strength of impact of these errors creating a list in descending order; (5) developing corrective and remedial actions for the most significant errors.

At this stage of risk management, it is important to assess and determine the form of risk evaluation and to make the right decisions to minimize the risk. For this purpose, a decision tree is a frequently used tool in Internet enterprises. It is a graphical form, which in its construction includes possible decisions made at different moments of implementation of activities for the project. The decisions made result from previous actions and events, to which values and probable possibilities have been assigned, defining possible variants. Each variant included in the decision tree should have a calculated and assigned value. For each decision, the value of the benefit should be calculated by multiplying the product of the benefit that the variant gives and the probability of its occurrence (Ziarkowski, 2004).

In the monitoring and control phase of risk management in organisations in the case of e-businesses, methods are most often used to check the validity and effectiveness of actions resulting from the decisions taken. The indicator method is undoubtedly one of the methods supporting the checks. It is supposed to provide information about the results of activities that are undertaken during the implementation of undertakings and about the financial situation of the organisation. During the indicator analysis, the following stages of control implementation can be distinguished (Kaczmarek, 2010): (a) identification of phenomena taking place in the organisation, which will become the subject of monitoring; (b) appropriate selection of indicators to assess selected phenomena; (c) evaluation and verification of indicators; (d) corrective actions to the measurement of indicators.

An indispensable tool in the control of e-commerce risk management is the analysis of compliance of the implementation of activities with the project plan. This can be done using the Earned Value Method (EVM). Analysis is based on a comparison of three data sets, which result from the planned budgeting, the budgets recalculated during the implementation of the activities and the real costs incurred. The sets are included in the following three budget datasets (Łada, 2005): (a) the budget for the work included in the plan; (b) budget for the work carried out; and (c) the result of current data.

Analyses using appropriate techniques, methods and tools at all stages of the implementation of specific activities prevent the occurrence of irregularities and avoidance of undesirable effects for the project. The decision-making process is an important element in risk management. The future expected state, position and situation of the organisation depends on the right decision.

One of the decision-making models is the "decision tree". In this model, in an orderly way, the sequence of actions and events is built hierarchy. Thanks to this, it is possible to present in a graphical way the analysis of many options of choice and consequences of decision-making at the same time. The aim of such an action is to simplify the assessment of the decision-making situation (Rebizant, 2012). The decision tree schematically illustrates the process that occurs at the time of data analysis, benefit and loss research. On the basis of such knowledge the final decision is made.

Nowadays, the search for new solutions in the field of decision making is transferred to the IT level and enriched by artificial intelligence. Neural networks are such a solution. These are computational methods whose task is to create knowledge bases thanks to acquired information. Knowledge *w* is used to solve problems, facilitate decision-making. The operation of neural networks in its structure is similar to a living organism reacting to stimuli and changes in the environment (Lula et al., 2012). In an age of large amounts of information, it is very difficult to make the right decision. Neural networks give a lot of computing power, and having a huge knowledge base allows for faster decision making.

It can be noted that there is a gap in the absence of an appropriate instrument to make decision making easier, more efficient and effective. This does not mean that the level of responsibility could decrease, but only that the level of difficulty and quality of decision making would decrease. The theoretical basis shows that there is a lack of a tool to support difficult decision making in risk management in a simple, clear way.

### **3 RESULTS**

#### **The concept of an implied risk management tool**

The selection of appropriate risk management tools and the ability to use them has a direct and significant impact on the effectiveness and efficiency of activities on which the future state of the company depends. The management systems and techniques used build the picture of the organization in the future. They make it easier to plan and control risks. in the organization. Situations often force us to look for new solutions to our activities. and the implementation of strategic objectives. Thanks to the use of implied tools, the management and the awareness of the risks and decisions taken on account of them is becoming more identical for the company, which results in a more accurate definition of the strategy and an easier level of its implementation. The selection of appropriate systems, techniques or tools for risk management, faster, more effectively and efficiently brings the company closer to success in the implementation of the intended activities.

**Analysis of risk management decisions taken**

Each risk-sensitive management activity is completed by a specific decision, which entails a number of activities aimed at supremacy. Therefore, a very important factor in decision-making is the assessment of the effects that a defined statement may have. It is worthwhile to analyse each statement taken for implementation in every possible way, eliminating the possible undesirable states that may appear, which bring a number of negative and not reversible consequences. The "ADT" tool - The analysis of the decisions made allows to take a broader look at the decision made or other specific value and to analyse it in terms of what profit it can bring, what opportunities for development it can bring. As a consequence of actions taken, what are we risking and what losses can be expected when deciding on a particular activity. The table below presents a schematic diagram of the "ADT" principle of action and a description of the conduct while using this tool.

DECISION-MAKING				
DECISION			FINAL DECISION	
LP	PROFIT - BENEFITS WHAT IS THE PROFIT?	RANK (1-10)	LOSS WHAT WE LOSE?	RANK (1-10)
1				
2				
3				
4				
5				
	THE OPPORTUNITIES FOR DEVELOPMENT WHAT IS THE	RANK (1-10)	RISK WHAT ARE WE RISKING?	RANK (1-10)
1				
2				
3				
4				
5				
		0		0
0				

Fig. 1 – Analysis of decisions taken “ADT”. Source: own research

**1) Benefits.** In the first stage it is necessary to consider what benefits will come out of the changes for the company, for the environment, for ourselves. The focus should be on what added value, intangible value, marginal benefit can be achieved. All possibilities should be entered in the "benefits" column focusing on the most important ones.

**2) Opportunities.** At this stage it is necessary to define the possibilities that the activity under consideration will give us (decision, strategy, goal). It is worth asking ourselves what development possibilities, what future prospects for the company, environment, people are visible in relation to the examined value.

**3) Risk.** The next step in this analysis is the need to diagnose what risk the company, environment, people at the time of implementation of the intended activities. What we risk, what we put on the scales on the way to achieving the planned undertakings.

**4) Loss.** A necessary element of a full analysis is to pay attention to what we will lose in the face of our activities. We consider losses in material and non-material categories. The factors that will reduce, decrease, e.g. financial-economic, ethical or moral value should be considered.

When carrying out the analysis, five factors of each group should be selected from among those mentioned, the most significant ones and those having the greatest impact on the examined phenomenon. Each factor should be assigned a significant importance in the understanding of how strong an impact a given argument may have on the company, environment and people. It should be noted that in the column 'benefits' and 'opportunities' the estimated values are added together and then in the columns 'risk' and 'loss' are differentiated from previous additions. It can be assumed that a result of more than fifty is a positive decision. It can be assumed that 0 to 50 is an undesirable decision and 50 to 75 is a decision not involving losses. and risk, while 75 to 100 are good and profitable decisions and not too much risky. It should be noted that the adopted valuation score is assumed for selected five most important factors in each group and the maximum number of points is 100.

In the considerations we are making, we can see a gap in the methods and ways of making decisions in risk management. The introduction of the "ADT" tool would allow to increase the possibilities of making decisions and thus make the decision more relevant, quicker and easier to make. The application of the ADT tool allows for more in-depth analysis, proper assessment, quicker response and effective decision making. The tool can be particularly useful in E-business activities, where decision-making should take place fairly quickly and the effect of the decision should be effective and efficient. The "ADT" tool is presented as a process of decision selection and shows a scheme of conduct for choosing the right and final decision in risk management.

## **4 DISCUSSION**

Decision making in the risk management process is the most important and the hardest thing to do. It is on the rightness of the decision that the effectiveness and efficiency of the implemented actions depends. Decisions are made at almost every stage of the management process, where risk is inevitable. In its concept, the proposed tool is supposed to help in making decisions and prevent erroneous and undesirable states in the future during the implementation of specific activities. in the organization. The "ADT" tool greatly simplifies decision making by illustrating and making them aware of the consequences of their choice. The presented tool for improving decision making perfectly fits into the process of risk management, which results from the fact that it is necessary to make the right choices, which directly translates into the success of achieving the assumed objectives of the organization.

## **5 CONCLUSION**

The risk is an unavoidable element that is borne during the implementation of a given project. It is an inseparable form that results in a specific decision. The ability to act and deal with the risk is risk management. Proper selection of techniques, tools and methods can significantly reduce the level of risk and even eliminate it completely. The literature of the subject provides a full range of possibilities of risk management. The art is to choose the right methods and models of risk management, and an even more difficult and important element is to skilfully and properly use the potential of a risk management tool. Threats that arise during the

implementation of specific activities can only be eliminated through appropriate risk management. Especially in the e-commerce industry, where the environment changes very quickly creating new problem-creating factors, quick reaction and correction will undoubtedly protect organizations from additional costs or complete failure of the activities. Making decisions is a very difficult and responsible task. The tool developed in its concept is designed to help in this important and important process, which concerns not only the discipline of risk management, but also every other sphere of human life that requires taking responsibility for decisions.

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