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BUSINESS DEVELOPMENT
IN DIGITAL ECONOMY
AND COVID-19 CRISIS

Edited by
Janusz Nesterak, Bernard Ziębicki

KNOWLEDGE – ECONOMY – SOCIETY

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Institute of Economics
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CRACOW
UNIVERSITY
OF ECONOMICS

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Introduction

Modern business development has been determined by information and communication technology. ICT has enhanced the efficiency of business processes and created new, innovative business models. These developments will enable the automation of processes and reduce the cost of information processing, becoming a key factor bolstering the efficiency of modern enterprises. This transformation is known as the fourth industrial revolution. Moreover, ICT is a fundamental determinant of business models related to the development of the sharing economy and e-commerce.

The Covid-19 pandemic has become an external factor that has exerted a major impact on the development of business over the last year. It has taken its toll on economies. Only a precious few industry have not suffered losses precipitated by this crisis. However, the situation has also forced many companies to change the way they operate. Enterprises have widely transitioned to remote working. Electronic sales channels and new forms of communication with customers have been developed. All of these have also involved the development and implementation of numerous innovations. It is to be expected that a big part of these solutions will continue to be further developed after the pandemic.

The dependence of modern business on ICT and the conditions of the socio- -economic environment, including in particular the Covid-19 pandemic, have made it necessary to implement fundamental changes in many enterprises. These involve financial management, business process coordination, building customer relationships, as well as human resource management. Their implementation has encountered multiple obstacles. Overcoming them is a precondition for ensuring business development and meeting the challenges of the modern economy.

This monograph is the result of scientific cooperation between the College of Management and Quality Sciences of the Cracow University of Economics and other scientific and business circles, such as Andrzej Frycz Modrzewski Krakow University, Cavalry Captain Witold Pilecki State University of Malopolska in Oswiecim, Kyiv National University of Trade and Economics, Poznań University

of Economics and Business, Jan Kochanowski University in Kielce, Witelon State University of Applied Sciences in Legnica, University of Economics in Katowice, University of Kragujevac, University of Lodz, University of Messina, University of Zielona Gora, Whise-Ukraine, LLC, Wroclaw University of Economics and Business, Wroclaw University of Science and Technology and WSB University in Dąbrowa Górnicza.

The monograph deals with the issues from both a theoretical and practical perspective. The topics are divided into the following three complementary parts:

- Digital Transformation and Innovativeness of Business,
- Impact of Covid-19 on Business and Society Development,
- Business Management Challenges in the Digital Economy.

The first part titled "*Digital Transformation and Innovativeness of Business*" is concerned with issues of modern business development in conditions of digital transformation. The issues discussed in this part relate to both macro- and microeconomics. The papers deal with issues involving the global development of the IT industry, commercialisation of knowledge and technology, artificial intelligence, the use of public and social networks in business, e-business, digitisation of business processes, as well as electromobility of modern society.

The second part of the monograph titled "*Impact of Covid-19 on Business and Society Development*" deals with the impact of the Covid-19 pandemic on the current development of business and society. It also presents general problems involved in change management and organisation development. Its main focus is on the economic recovery after the Covid-19 pandemic, remote communication and the competitiveness of enterprises. These issues are considered from the perspective of various categories of organisations, both business and public, as well as social development.

The third part titled "*Business Management Challenges in the Digital Economy*" presents the challenges of managing enterprises in conditions of the fourth industrial revolution, dominated by information technologies. The issues explored in this part relate both to the contemporary conditions of corporate finance management and the importance of digital competences, creating and implementing innovations, as well as the use of modern media and information technologies to stimulate companies' effectiveness and competitiveness.

As scientific editors of this monograph, we wish to express our gratitude to all Authors for accepting the invitation to co-create it and share the results of their research with the readers. We would also like to thank the Reviewers: professors Agnieszka Bieńkowska, Dagmara Lewicka and Marek Dudek for their valuable contribution to the shape of the contents of this publication.

Janusz Nesterak, Bernard Ziębicki

PART I DIGITAL TRANSFORMATION
AND INNOVATIVENESS OF BUSINESS

International Strategic Alliances in the IT Industry

Ganna Duginets, Kostiantyn Nizheiko

1. Introduction

In recent decades, with the growing globalization, the IT industry has begun to pay increasing attention to long-term inter-organizational cooperation agreements. The formation of strategic business partnerships between companies in the IT industry today is an important condition not only for their survival but also growth. Complexity, risk and a certain degree of future uncertainty are characteristic features of the modern "business environment". Dynamic market conditions increase competition in the IT sector, shorten the life cycle of its products, which helps companies to review traditional methods and strategies to improve the state of business. The average IT firm often does not have all the resources and capabilities it needs to achieve the minimum goal of competition, which is to retain its current customers. One of the ways out of the current situation for a company representing the IT industry is its participation in an international strategic alliance.

The issues of formation and functioning of international strategic alliances in their works were covered by: D. Blakey, M.O. Bobina, B. Gomez-Casceres, D. Dyer, M.O. Yefimova, VM Zavarzin, P. Cale, I.Ya. Maksymenko, R. Narula, K. Sakai, H. Sinh, O.R. Syrytsia, V. Tronko, J. Fadol, D. Hook, M. Shenli, L. Shulzhenko, K. Yuin and others.

A wide range of foreign and domestic scientists have devoted their works to the study of the motives for the formation of strategic alliances, development, prospects for cooperation and the most attractive areas of formation. For example, D. Blakey, K. Gon, I. K., B. Gomez-Casceres and others, highlighted their views in a joint collection of "Strategic Alliances" (Blakey et al., 2008). The collection discusses a wide range of issues related to partnerships between companies: the reasons and ways to create strategic alliances, strategies for maintaining alliances and maintaining mutually beneficial cooperation in partnerships. Also

interesting is the study of M. Echavarria "Ensuring cooperation: achieving success through strategic alliances and partnerships" (Echavarria, 2015). This scientific work is one of the first practical manuals for successful strategic cooperation. This scientific work is one of the first practical manuals for successful strategic cooperation. To do this, it reveals a structure that combines the methodology of joint leadership with a revolutionary process of developing strategic alliances that can be applied not only to any industry, but also to partner organizations of various sizes. V. Tronko in his study "Formation of international strategic alliances in the field of telecommunications services" (Tronko, 2010) analyzed the preconditions and determinants of the formation of international strategic alliances and identified current trends in ISA in the telecommunications services market of Ukraine. Also of some interest is the work of L. Shulzhenko "Foreign and domestic experience in creating strategic alliances" (Shulzhenko, 2012), in which the author analyzes the practice of forming strategic alliances, which has become widespread in the field of international cooperation. However, the studies of these authors: first, are outdated; secondly, they concern the issues that determine the conceptual and categorical apparatus of international strategic alliances. In addition, they only superficially consider aspects of the formation and operation of international strategic alliances in the IT field.

2. The Aim of the Research

Analyze the essence, goals, advantages and disadvantages of forming international strategic alliances in the IT sphere, characterize and determine their dynamics.

3. Research Methods

The study was conducted using the methods of theoretical generalization, comparative analysis, analysis and synthesis, induction and deduction, which allowed establishing the factors that determine the prerequisites for the creation of ISAs between companies in the IT field, as well as the characteristics of international strategic alliances. technologies.

4. Results of the Research

The International Strategic Alliance can be imagined both as a rational combination of resources of ISA participants, and as an agreement on cooperation, and as a means of achieving competitive advantage, etc. The main difference between the ISA and conventional alliances is that it is always burdened

by a foreign element. The International Strategic Alliance includes cross-border flows and communications that use the resources of the Alliance members, headquartered in different countries, to jointly achieve their goals. In themselves, international strategic alliances are not a new phenomenon, their "boom" around the world occurred in the 1990's. Now they are experiencing a "second birth", however, it should be noted that recent trends in international strategic alliances differ from past trends in several respects, including: increasing importance for partners in increasing competitiveness, stimulating production growth and market coverage in existing crisis conditions; depth of interaction between partners; significant impact of ISAs on corporate performance in general.

It is worth noting that the range of firms that act as partners of ISAs has significantly expanded. Today, they are represented not only by the "big players" in the IT market, but also by small and medium-sized firms, which, fearing takeovers, have always avoided joint ventures or close cooperation with other firms in their core business. And while the risk has not gone away, it has become more predictable, especially since most small and medium-sized IT companies entering the ISA aim to be subsequently absorbed by a dominant alliance partner.

International strategic alliances offer an alternative approach in which firms in the IT industry can join forces to find opportunities that would otherwise be beyond their current strengths and resources. In any case, the international strategic alliances in our field are determined by the economic requirements of the global IT market, the costs associated with changing technologies, and the opportunities that open up. ISAs have emerged and become widespread as a popular strategy in an environment where rapid access to advanced technologies and emerging markets is more important than ever.

In the early 1980's. there have been significant changes in the structure and mechanism of competition in the field of information technology. This was mainly due to the narrowing of the decades-old gap between IBM (an international leader in computer and other technologies) and its competitors. The emergence of new technologies, aggressive new competitors both in the United States (Apple Computers, Sun Microsystems, etc.) and in other countries, the expansion of markets in different parts of the world have led, in turn, a significant increase in interdependence of companies in information technology.

In response to growing pressure from competitors, US corporations have changed their strategy and revised their position on strategic alliances. In particular, IBM lifted existing restrictions on the creation of joint projects and enterprises based on participation in joint ownership. The adoption of the alliance's strategy in the 1990s was reflected in IBM's management calling its corporation a "constellation of businesses", and a significant number of its autonomous

business units were jointly owned by other firms. The number of alliances at the end of the decade was estimated at hundreds, and especially intensified inter-firm cooperation in the field of information technology (Bobina, 2001).

From 1996 to 2002, the share of scientific and technical alliances of high-tech industries accounted for 80% of all created scientific and technical alliances and 20% – for medium-tech industries (Harvard Business School Press, 2002). At the same time, 14% were in alliances related to information and computer technology. Less than half of them were concluded in the form of international strategic alliances. The participation of domestic IT companies in such alliances was minimal as in the 1990's. Ukraine went through a widespread restructuring to transit from the planned to market economy, had unfavorable tax and customs legislation, a low number of domestic IT companies, minimal trust of foreign partners in domestic IT market representatives, a significant lag in the level of scientific and technological progress in Ukraine, and others. In addition, domestic companies themselves did not seek to enter into alliances with foreign companies, as it was proposed to create them on the basis of unequal partnership.

As of 2010, the number of strategic alliances in the IT sector reached 16%. More than half (61%) of the alliances created were aimed at developing new software, and 27% – at selling existing products and general commercial development ("market conquest"). It should be noted that the creation of ISAs in the IT sector is significantly influenced by the telecommunications sector, which since 1992 has expanded annually by an average of 7%.

The active formation of international strategic alliances in the IT sector is the result of a significant expansion of the global market for information and communication technologies, including equipment, services and software, as well as telecommunications, which in 2020 amounted to US$ 3.69 trillion.

Creating systems or devices that can dominate the market is the key to the long-term prosperity of developers and manufacturers of information and communication technology equipment and software, as well as firms in the electronic (manufacturing) industry as a whole. Once a system or device is recognized as the standard (Micro-USB – the standard for charging smartphones and phones, Blu-Ray – the standard for optical media for recording high-definition video, etc.), its original inventor (firm) can save on production and sell the technology involved as a licensor. Developers of software and hardware for communications are actively forming alliances with competitors in the field of R&D and marketing, in order to accelerate the breakthrough in product development and promote jointly developed products around the world. Since marketing and advertising play a key role in transforming certain products into global standards, many alliances in the telecommunications and electronics sectors are formed between

large companies that have a dominant marketing power in regional markets (Kang&Sakai, 2000). It is worth noting that compared to 2019, due to the COVID-19 pandemic, this market shrank by 3.2%. At the same time, the large-scale spread of coronavirus contributed to digitalization: businesses were forced to transfer staff to remote work, and educational institutions – to distance learning, which stimulated demand for cloud and other IT tools. In 2021 and beyond, the level of digitalization of internal processes, supply chains, mechanisms of interaction with customers and partners, as well as the provision of services is expected to increase. The pandemic of the COVID-19 virus has already accelerated the digitalization of the world economy by 10 times, thanks to which the IT sector is waiting for further significant expansion.

It should be noted that the European and American markets perceive the representatives of the Ukrainian IT industry not as equal partners for the creation of ISAs, but as excellent performers in outsourcing. Ukraine ranks 4th in the world in the number of technicians behind the United States, India and Russia. At the beginning of 2020, the number of IT staff was about 200 thousand people. It is expected that by the beginning of 2021 the capitalization of the Ukrainian IT industry will reach 10 billion dollars. USA. In Ukraine, there are 1,500 IT companies that offer almost all types of information services, including the development of web applications and mobile devices, UI/UX development, research and development, IT consulting, analytics and more.

The IT industry has rapidly adopted and transformed for its needs such a typical for the traditional economy form of economic integration as an international strategic alliance. During the transformation, the ITA of the IT industry developed the following characteristics: a high level of openness and virtualization for medium and small companies; aggressive policy of building alliances for major IT players in all areas of business development; a positive outcome of the ISA's operation contributes to the further merger, acquisition or acquisition of alliance partners. The peculiarities of ITA development in the IT industry in Ukraine (as a form of international cooperation) are as follows: the total number of ISAs whose partners are domestic companies is increasing; ISA for domestic IT companies is a new form of inter-firm cooperation; domestic IT companies joining the ISA, gain experience, technology, investment, and foreign partners – the development of a new market.

Firms recognize that competition and collaboration are necessary to ensure optimal growth based on innovation. International strategic alliances are now considered one of the most powerful mechanisms for combining competition and cooperation, as well as restructuring industry on a global basis. The creation of cross-border alliances is the result of increasing competitive pressure

from more integrated global markets. International alliances arise in many different industries, and between firms of different sizes. Firms form alliances, pursuing various goals, such as saving production and research costs, strengthening market positions and access to intangible assets of other firms (Kang&Sakai, 2000), entering a new market, expanding activities, production partnerships, etc. In the IT field, we can distinguish two groups of goals for the creation of ISAs. Additional goals (in addition to those already mentioned above, inherent in all ISAs) should also include the desire to redistribute and reduce the cost of researching information products, to reduce the lead time from product research to the time of its commercialization. The main goal is to develop new information products, standards or systems. Note that proponents of the concept of ISA, based on knowledge, argue that the exchange of knowledge, including technology, know-how and organizational capabilities, as well as learning from partners are the dominant goals of alliances (Yasir Yasin Sid Ahmed Fadol, 2010). Thus, by learning and sharing valuable knowledge with partners, strategic alliances help companies overcome limitations in their own set of resources by solving internal problems.

International strategic alliances, more than other forms of long-term agreements between two or more partners, provide their participants with strategic flexibility, allowing them to respond to any changes in market conditions. Flexibility is a key advantage of international strategic alliances over traditional hierarchical organizations. The advantages of international strategic alliances in the IT field, in addition to competitive advantages, also include risk sharing, exchange of resources, access to new markets, achieving economies of scale and synergies. The obvious advantage of ISAs is that partners have access to exactly the resources they need and find unattainable outside the alliance.

International strategic alliances can also serve as a "platform for exchange", on the basis of which partners learn and acquire from each other technologies, skills and knowledge that are not available in their own organizations. This advantage is especially relevant for domestic representatives of the IT market, which are participants in the ISA. Under the ISA, partners can learn from each other's past experiences and share their knowledge. At the same time, the level of access of partners to knowledge and experience largely depends on the existing level of trust between them. Over time, as trust levels grow, partners will be more confident in sharing more information at the strategic and operational levels. If partners do not trust each other, the transfer of experience, knowledge and technology within the ISA is much more difficult.

The advantage of ISAs over mergers and acquisitions is that the organization only temporarily gives up some of its resources, which remain available for future internal use after the end of the operation of ISAs.

However, international strategic alliances have both advantages and disadvantages. Yes, ISAs may pose more risks in their implementation, while mergers and acquisitions may provide a combined firm with a more integrated decision-making structure. Partnerships complicate decision-making and control processes. The process of implementation of the alliance, as evidenced by the experience of domestic ISAs in the IT field, is beyond the control of the Ukrainian side. In addition, the ISA partner may establish a cooperative relationship with competing firms, which may hinder an existing alliance. As partners build more and more alliances, it becomes increasingly difficult for them to maintain a balance between alliances. Some partners can get more than others, and unequal benefits can hurt the partnership. Large partners tend to dominate smaller partners, and can unilaterally significantly influence and change relationships and strategies within the alliance. As a result, a strategic alliance for a non-dominant partner may result in higher transaction costs with less joint investment than a full merger.

5. Conclusions

International strategic alliances in the field we study are formed in response to the challenges facing companies in the IT industry. ISAs are initially formed in response to changes in the market environment and organizational circumstances. Today, they are becoming an integral part of the competitive strategies of domestic IT companies, which are already "close" to the usual outsourcing. Domestic IT companies are in favor of concluding international strategic alliances with European and American partners. The reason for this is both the rather rich experience of foreign partners in the formation of ISAs and the desire of domestic companies to enter the international markets (European and American) reducing their costs and risks.

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Reframing Approach for Smart and Intelligent Enterprises Based on Artificial Intelligence and Business Process Automation[1]

Zora Arsovski, Slavko Arsovski, Aleksandar Djordjevic

1. Introduction

A Smart Industry described as "Industry 4.0" is now in emerging phase. It is answer on main market challenges related to: (1) market volatility, (2) increase in material costs, (3) price reduction pressures, (4) increase of labor costs, (5) increase in transportation/logistic costs etc. These and other more global challenges have not an easy answer and not for all business situation.

Authors need one system approach for resolving this process of transition to smart enterprises appropriate for Industry 4.0. This approach is based on previous developed Grounded Theory, Leading Change, Business Process Reengineering, Digital Business Models, Sustainability on upper level and, lot of methods on middle level, as Conceptual Modeling, Business Process Management (BPM), Business Process Automation (BPA), Assets management, Lean Manufacturing, Total Quality Management, Management by Goals, etc. On the ground level are structured different tools as Artificial Intelligence (AI), robotics, sensors, Internet of Things (IoT), Internet of Everything (IoE), smart infrastructure, smart people, smart energy, smart processes, smart process leadership, etc.

The subject of the research presented in the article is the process of transition of existing enterprises (dominantly on level of Industry 3.0) to smart enterprises appropriated for Industry 4.0. Using system approach is developed a methodology called TESSIE (Transition from Existing to Sustainable, Smart

and Intelligent Enterprises) which includes a lot of drivers, factors, performance indicators etc. The paper emphasized roles of AI and BPA.

AI and BPA were partially applied in Industry 3.0, but now are more sophisticated and need more potential to satisfy market challenges. It is not only related to lowering costs of manufacturing and transportation/internal and external logistics etc. More that, it has an impact on designing manufacturing and more broadly on production processes. So an emerging development of AI and BPA is not only on the level of tools but even on the level of methods and approach. The results of this impact are shown in many case studies and praxis, but reaching the goals was in many cases problematic.

In our approach AI and BPA are structured into components, defined relations among them and relations with upper level. They are input and also drivers of change to Smart Enterprises (SEs). On the basis of a conceptual modeling technique and dynamic modeling a set of models for different business situation is defined. Based on it the authors verifie TESSIE proposed for one medium enterprise in Serbia as a developing country with high ambition for fast development focused on Industry 4.0.

The article consists of five chapters. The first chapter (Introduction) provides basic information about TESSIE, goals, purpose, methods and tools for introduction of AI and BPA.

Chapter two presents the background related to: (1) approaches, (2) methods and techniques, and (3) tools with emphasis on AI, BPA and stated hypotheses.

Chapter three presents TESSIE methodology for achieving Smart and Intelligent Enterprises (SIE) using AI and BPA. It is developed on three levels.

Verification of modeling results (Chapter four) is performed in a case study for one middle "classical" industrial enterprise, with relatively common constraints and market position.

The conclusion (Chapter five) presents a discussion and conclusions based on the results of previous research.

2. Literature review

A process of transition from existing to smart and intelligent enterprises is analyzed in the last ten years from different aspects and situations. The literature related to TESSIE could be divided into five interrelated topics, i.e.: (1) challenges and needs for introducing smart technologies, (2) approaches and methods for business process transformation, (3) AI and BPA, (4) BPM and new business models, and (5) smart sustainability.

A challenge is now in an emerging phase. Conseqently, in a special research report published by the Industry weekly (*KRONOS*, 2016) are emphasized top eleven market challenges, i.e.: (1) market volatility, (2) market costs, (3) price reduction cost for better price competitiveness, (4) labor costs, (5) transportation/logistic costs, (6) environmental laws and regulation, (87) business regulations, (8) global competition, (9) labor laws and regulations, (10) global geopolitical risks, and (11) global expansion. In the process of converting business strategy to execution the key role is played by five competitive differentiators: (1) new product development cycle times, (2) age and capabilities of production equipment and technology, (3) overall cost structure, (4) order-to-delivery lead time, and (5) speed of management making. In all of them AI and BPA are recognized as tools to achieve competitiveness.

Gladden (2019) analyzed goals of the Society 5.0 initiative and its dependence on transformative future technologies, such as AI, robotics and human machine integration as post humanization future.

A study by T. Zanni & F. Grandi (2019) recognizes the millennium perspective with priorities: (1) AI, cognitive computing, machine learning, (2) IoT, (3) 5G, (4) increased computational power such as quantum computing, (5) robotic process automaton with software bots, (6) social networking, collaboration technologies, (7) digital payment platforms, (8) robotics and automation, including autonomous vehicles, (9) mega platforms such as Amazon, Facebook, Alibaba, and (10) voice, speed and chat interaction. The biggest challenges for companies to adapt to these technologies are: (1) unproven business cases, (2) technology complexity, (3) security, (4) regulatory compliance, (5) legacy technologies, (6) lack of capital to fund new investment, and (7) limited experience to turn data into valuable results.

The second group of literature related to approaches and methods for business process transformation. So L. Bolman & T. Deal (2008) introduced the term "reframing" to state emergency for a new approach for the new age. Based on making sense of organizations with including aspects of power of reframing and complex organization they defined: (1) new structural frame, (2) human resource frame, (3) political frame, (4) symbolic frame, and improving leadership practice. All of them can be viewed as change processes and they are closely coupled with J. Kotter's concept of Leading Change (2012). The developed eight-stage change process has the following stages: (1) establishing a sense of urgency, (2) creating the guiding coalition, (3) developing a vision and strategy, (4) communicating the change vision, (5) empowering broad-based action, (6) generating short-term wins, (7) consolidating gains and producing more change, and (8) anchoring new approach in the culture.

The Grounded Theory is based on the work of B. Glaser & A. Straus (2006). After repeating process of generating theory by comparative analysis and flexible use of data in the presented part of our research is made of theoretical elaboration of quantitative data for assessment the relevance of the developed concept.

Statistical methods are performed based on SPSS software developed by IBM. Use is made of the Data Envelope Analysis (DEA) method based on works of R. Ramanathan (2003), W. Cooper, L. Seiford & K. Tone (2000).

Artificial Neural Networks (ANN) are tools for data mining using biological background based on works of A. Djordjevic, et al. (2018), and C. Bhargava, J. Aggarwal & P.P. Sharma (2019).

The third group of literature is related to AI and BPA. According to an *OECD* study (2019), AI reshaped the economy and results in higher productivity, efficiency and lower costs. It changes, business, innovativeness, and other aspects of life as transport with autonomous vehicles, agriculture, finance, marketing, science, health, criminal justice, security, public sector, augmented and virtual reality. Additionally, governments develop or adapt AI policies and initiatives toward economic development and higher competitiveness.

The "hot" areas of AI research are: (1) large scale machine learning, (2) deep learning, (3) reinforcement learning, (4) robotics, (5) computer vision, (6) national language processing, (7) collaborative systems, (8) crowd sourcing and human computation, (9) algorithmic game theory and computational social choice, (10) IoT, (11) neuromorphic computing, etc. AI shifted from simple intelligent building systems to building intelligent systems that are human-aware and trustworthy. All of previous AI areas are included in industry, especially in smart and intelligent enterprises (SIE).

The future of AI (Pregalinska, 2019; Bordelan at al. 2018) involves a transition from low familiarity to human likeness, from industrial robots (IR) to humanoid robot, healthy person etc.

Aspects of BPA have a long tradition. Starting from the concept of Flexible automation, CIM systems, and flexible production systems, BPA now includes new smart technologies in different areas.

Thus a work of G. Oswald & H. Krcmar (2018) analyzed the state of digital transformations, technological trends of digital transformations and the impact of digital transformation on competitiveness and new digital business models.

A. Low (2019) analyzed technical standards for Smart manufacturing starting from the definition "smart manufacturing is the convergence of operating technologies (OT) and information technologies (IT) working together in a real-time integrated fashion".

A. Schütze, N. Helwig, & T. Schneider (2018) analyzed sensors 4.0 as smart sensors and measurement technology enabling Industry 4.0. They started from application with of target functionality and constraints and then in phase two analyzed available modules with sensor principles, hardware and software. Phase three involves the design of application-specific sensor system with an interface board to the phase of application and training.

B. Agaton & G. Swedberg (2018) evaluated old and developed new methods to access Business Process Suitability for robotic process automation. They started from an analysis of processes suitable for RPA (Robotic Process Automation). Subsequent analysis examined methods and gave criteria for modeling and evaluation of business processes and roles of RPA. Eventually, they suggested improvements and paths to validity.

A work by T. Kalsoom et al. (2020) defined smart factory and its difference from a traditional factory. The smart factory is characterized by four intelligent features: (1) sensors, (2) interoperability, (3) integration IPA and AI, and (4) virtual reality techniques.

The four group of literature is related to BPM and new business models.

Smart enterprise maturity is analyzed in a work by G. Weichart, et al. (2015). The authors analyzed complexity of an S3 (Sensing, Smart and Sustainable) enterprise as a complex adaptive system. They discussed several viewpoints, i.e.: (1) enterprise viewpoint, (2) information viewpoint, with barriers and concerns, (3) computational viewpoint, (4) engineering viewpoint, and (5) technology viewpoint. In the next part of their research, the authors defined the architecture of the MDSEA (Model Driven Service Enterprise Architecture) and care ontology.

A. Molina et al. (2014) designed a S^2 – enterprise (Smart x Sensing) reference model using CIMOSA and other referent models and standards. They proposed a model with five viewpoints: (1) technology, (2) engineering, (3) computational, (4) information and (5) enterprise.

To achieve sustainable success, is essential to attract, develop and retain people through: (1) leadership/management training, (2) performance management, (3) skill training, (4) employee recruitment, (5) compensation incentives, etc.

Works by T. Zanny & T. Grandi (2019) emphasized top 10 technologies for business transformation: (1) IoT, (2) robotics process automation, (3) AI, cognitive computing, machine learning, (4) block chain, (5) robotics and automation including autonomous vehicles, (6) augmented reality, (7) virtual reality, (8) social networking, collaboration technologies, (9) biotech, digital health, genetics, and (10) on – demand marketplace platforms.

Other authors analyzed challenges and current development for sensing, smart and sustainable enterprise system. They emphasized methods to cover

collaboration, a method for better management of enterprise architecture, and improving the use of architectures and models. Also they analyzed supporting learning and evolution of the S3 enterprise.

Smart sustainability is a relatively new approach. It is developed on the basis of a Sensing, Smart and Sustainable manufacturing enterprise (D. Chavarria-Barrientos et al. 2017). In a previous concept smart covered: (1) intelligence, (2) collaboration, (3) integration, and (4) adaptability. A sustainable concept covers: (1) economic sustainability, (2) social responsiveness, and (3) environmental sustainability.

3. Reframing SMEs into Smart and Intelligent Enterprises (SIE) using AI and BPA

3.1. Methodology

The TESSIE covers five interrelated areas: (1) challenges and needs for introducing smart technologies, (2) approaches and methods for business process transformation, (3) AI and BPA, (4) BPM and new business models, and (5) smart sustainability.

The challenges and needs for introducing smart technologies are described in KRONUS (2016). The approaches to and methods of business process transformation are described in literature from the field of quality, business process reengineering, business complexity, and organizational design.

Concepts of AI and BPA, BPM and new business models are described in chapter two. Chapter 2.3 presents literature related to smart sustainability. The methodology of reframing of transition process of traditional SMEs into SIEs is based on four approaches and theories: (1) Grounded Theory, (2) Reframing organizations and (3) Leading Change and Contents Analysis.

Based on these approaches and theories, the original methodology TESSIE presented in Figure 2.1 is developed. In the proposed methodology the first step is context analysis based on literature and especially context of SIE. The result of this analysis is problem statement. The second step involves conceptual modeling of SIE based on previous defined problem statement and adopted methodology for conceptual modeling. The next steps are performed according Figure 2.1.

The final result of our research is positive feasibility study as a basis for the strategy of reframing enterprise into SIE.

The proposed seven steps of TESSIE methodology are logically related and the decision about their application in real business condition depends on the results of the feasibility study (step seven).
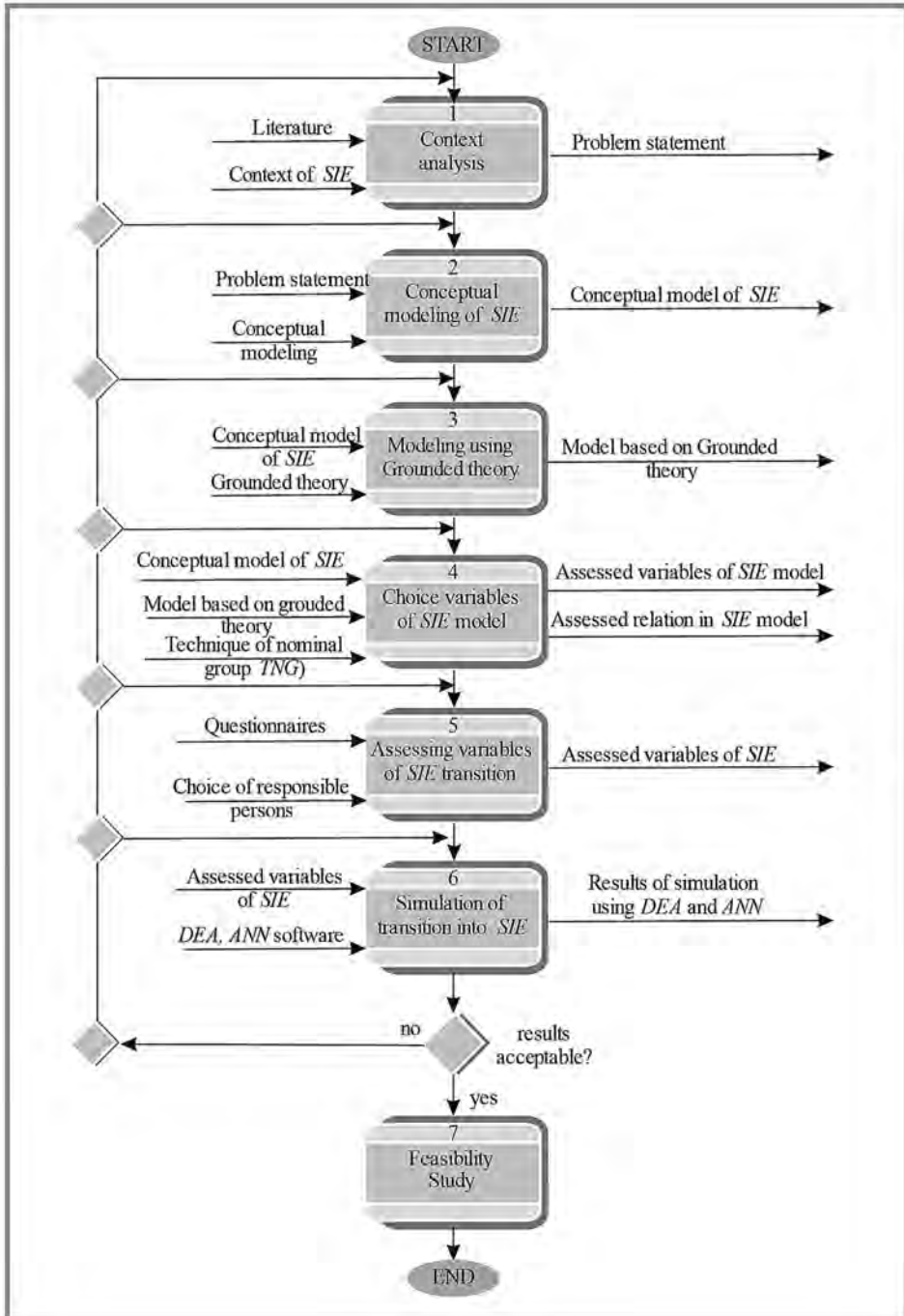
Figure 2.1. Seven steps of TESSIE methodology
Source: own research.

3.2. Transition model

This article presents the 3rd step (Modeling using Grounded theory). Figure 2.2 presents the base model of traditional SMEs from the point of view of a transition into SIE.
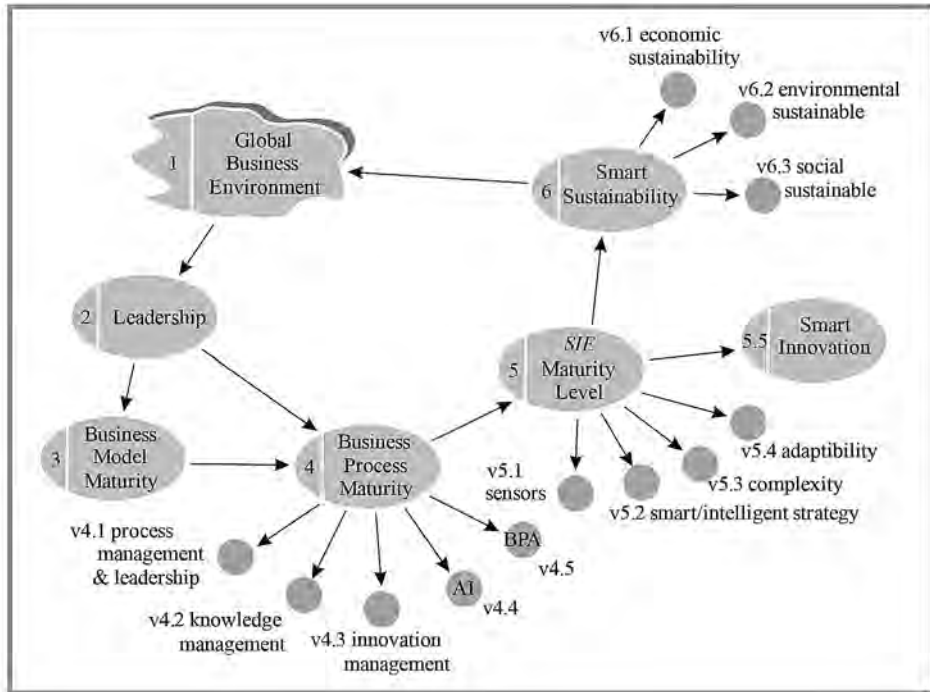
Figure 2.2. Base model of transition of traditional SMEs into SIE
Source: own research.

Starting from the base model, it's necessary to move to the next step involving making of a choice of variables and sub-variables for each of the variables. The proposed model has five independent variables and one depended variable (SIE Maturity Level). The presented results include analysis of two sub-variables, i.e. AI (Variable 4.4) and BPA (Variable 4.5) and their impact on Smart Sustainability (Dependent variable V6).

Verification of modeling results is performed for one medium industrial enterprise from Serbia.

Using TNG sub-variables are defined and their values are assessed for the past twenty years on a scale of 1 to 10. After creating an Excel file in the first step

the DEA method is used to find positions of the enterprise during the last twenty years (Figure 2.3).
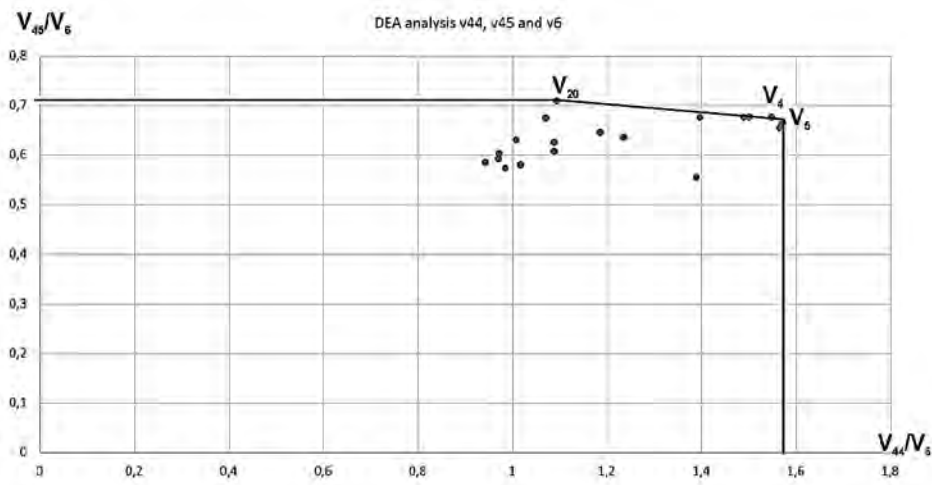
Figure 2.3. Efficiency of enterprise in last twenty years
Source: own research.

The best efficiency was found in year twenty and the efficiency area was limited also with BPA in year four, as well as with AI in year five. The mean efficiency was relative high ($t_e = 0.917$).

Moreover, in most years efficiency was achieved a rise in BPA. As a next step a simulation of the impact of BPA and AI resulting from improvement of AI by 20%, 50% and 100% and of BPA by 20%, 40%, and 80% in years 22, 25, and 30 respectively is performed.

For the purpose of the simulation use is made software created for ANN with one hidden layer and a validated proposed model. The regression coefficient for the year totaled R=0.9412, which is an extremely high value (Figure 2.4a and 2.4b).

In next phase, an ANN prediction of values of variable V6 is performed according to real values of AI and BPA over the next ten years. The increase in V6 over the next ten years was based on investment in AI and BPA. The value of V6 enhanced from 2.7989 (year 20) to 3.3406 (year 30). It is an increasing of approx. 25%. It is very respectable for the feasibility study and further investment in SIE based on AI and BPA (Figure 2.5).
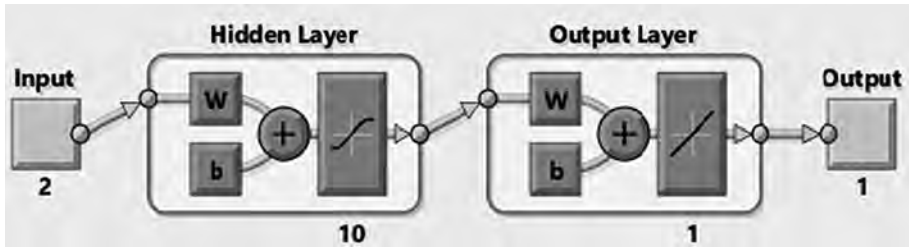
Figure 2.4a. Creation of ANN
Source: own research.
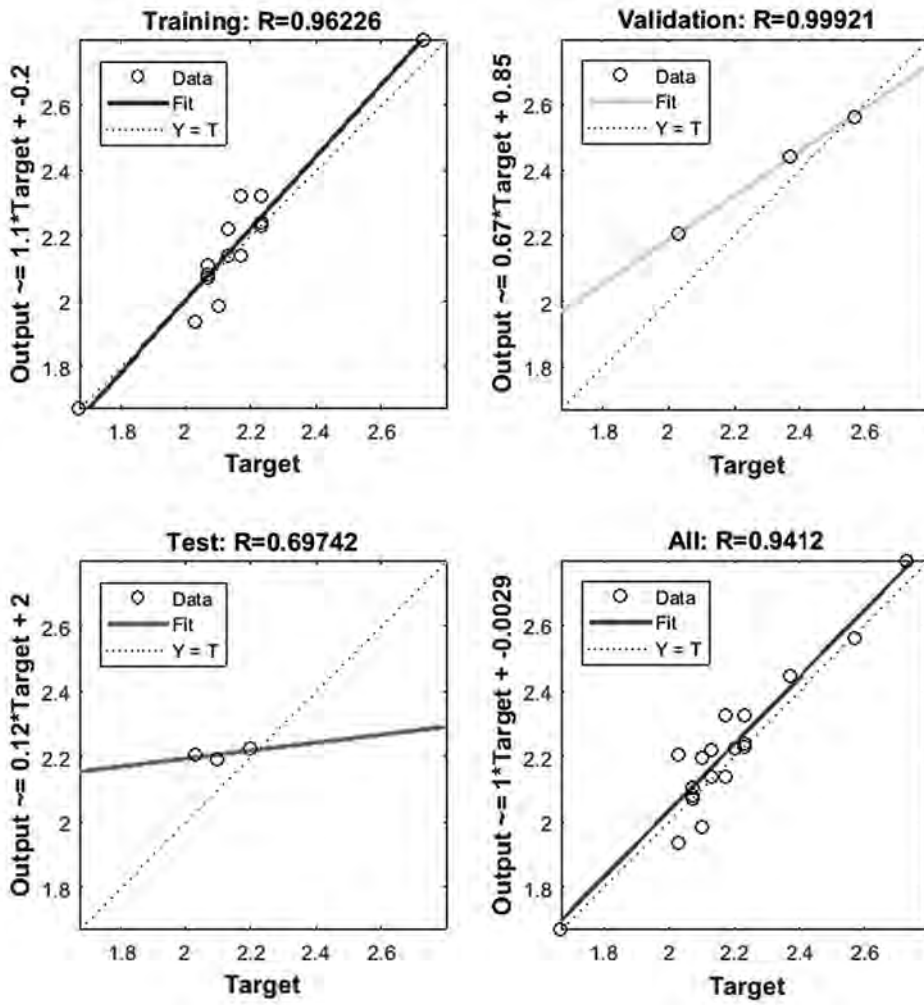
Figure 2.4b. Regression coefficients of the ANN
Source: own research.
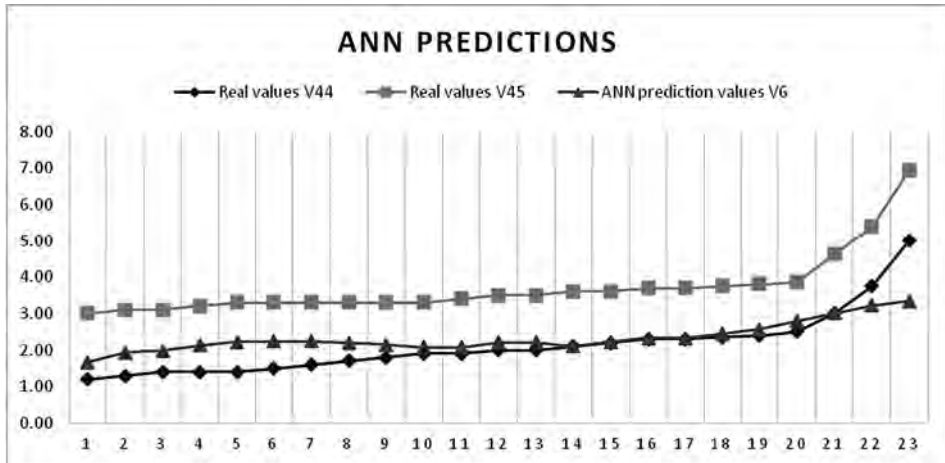
Figure 2.5. Prediction of Smart Sustainability using ANN
Source: own research.

4. Conclusions

The article analyses state-of-art SIE based on this literature a seven steps TESSIE methodology is developed. This methodology is possible thanks to TNG, DEA, and ANN methods based on developed model with six variables. The goal of the research was to assess the impact of AI and BPA on Smart Sustainability as a dependent variable in the last twenty years in one medium enterprise in the Republic of Serbia. Relatively high efficiency of AI and BPA (mean value was 0.917) is assessed using DEA and improvement Smart Sustainability by approx. 25% is predicted on the basis on ANN in ten years with proposed investment in AI and BPA.

In the future research will be performed with other variables and sub variables of the developed model of TESSIE.

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Commercialization of Knowledge and Technology – University and Business Sector Example

Karol Rusin, Barbara Mróz-Gorgoń, Marta Zając-Ossowska

1. Introduction

University education in the time of COVID-19 and after the pandemic, striving to improve the knowledge and technology commercialisation indicator, has to face the issue of the quality of distance learning forced by the pandemic situation, whose quality is evaluated as low by the business (GE Global Innovation Barometer, 2020). Another challenge to face is posed by the innovation's legal environment and the organisation's ability to adapt to market requirements. Universities have slowly got accustomed to handling the external and internal heterogeneity, but in the case of many universities, including Polish ones, the academic units responsible for the transfer of knowledge and technology fulfil the role of mediators between science and business (Stemberkova et al., 2020).

It can be concluded that the legislator's role is of crucial importance in providing conditions for innovation incubation and in increasing the level of knowledge commercialisation. The validity of such a thesis can be proven through insight into the American legislation that created favourable conditions for innovation development and commercialisation of knowledge. Owing, e.g. to Patent and Trademark Act (also known as Bayh-Dole Act), the annual revenue from licences went up from USD 160 million in 1991 to USD 862 million in 1999, while the number of academic patents grew from 300 in 1980 to 3661 in 1999 (Siegel, 2004).

The current legal framework for the commercialisation of knowledge within Polish universities is stipulated by the regulations in Chapter 6 of the Act of 20 July 2018 – "Teaching and higher education law". According to the regulations, universities are allowed to promote innovation and commercialise knowledge and technology by establishing academic entrepreneurship incubators, technology transfer centres and companies. With regard to the topic of the paper, the

authors focus only on the technology transfer centres and the possibility of universities' establishing and joining companies. In art. 148 of the referenced act, the legislator explicitly defined different objectives of technology transfer platforms and incubators' operation, setting direct commercialisation as the centre's task (Izdebski et al. 2019). The possibility of establishing special-purpose vehicles or corporations by universities makes an economically relevant option. The entities' operation focuses on the implementation of research infrastructure undertakings. Polish universities often decide to establish special-purpose vehicles. They tend to be single-member entities, with the university being the only shareholder. Their purpose is to implement the results of scientific activity or know-how. Such entities can be featured with research infrastructure and rights to manage the results of work or know-how. The effective regulation approves the establishment of special-purpose vehicles by a few universities, which should be evaluated positively as a solution that fosters interdisciplinarity of research and development works and boosts cooperation between different science disciplines. Essentially, social sciences and humanities see the strongest cooperation (Wieczorek et al. 2021), posing both a challenge to and an opportunity for Polish science. Universities shall perceive commercialisation as a chance for cooperation and development of new solutions by trying to establish special-purpose vehicles together and not competing with one another.

The evaluation criteria in force do not promote such an approach, though. The rules of transferring the work outcomes can be evaluated as positive. Universities are not eager to commercialise the outcomes of their employees' works. Despite the generally good legal framework for innovation incubation and commercialisation of knowledge by Polish universities, the patentability and revenues from licenses in universities are low. For instance, the Wrocław University of Technology, the leader in the number of patents (651) in the period 2011–2014, received only 997,000 PLN from the licence fees, while the Warsaw Medical University, with a total of 23 patents, obtained no revenue from licenses in the same period (Klincewicz & Marczewska 2017).

The aim of the paper is to analyze the knowledge and technology transfer models known in the literature of the subject and approximate the conditions (including barriers) of functioning and postulated models of knowledge and technology transfer within the Polish market.

2. Knowledge and Technology Transfer – Literature Review

Knowledge and technology transfer (KTT) is not a new thing, based on the literature review. Researchers have traced back the process to the pre-history of

the human species: where the process largely involved tacit knowledge which is evolutionary prior to explicit "the wisdom of humanity" (Donald 1991; Mathews & Roussel, 1997, see also: Wahab et.al. 2009). Table 3.1 presents the literature review of the models concerns the knowledge transfer.

Table 3.1. Literature Review of the Knowledge Transfer Models

Year	Author	Range	Key Factors of the Model
1992	Kogut & Zander	Environment - Organizations	The foundation for the knowledge-based theory of the firm when emphasizing the strategic importance of knowledge as a source of competitive advantage. The authors' work is focused on the idea that "what firms do better than markets is the creation and transfer of knowledge within the organization".
1994	Nonaka	Environment - Organizations	The proposal of the model for understanding the knowledge creation process in organizations in which organizational knowledge is created through a continuous dialogue between tacit and explicit knowledge.
1996	Grant	Environment - Organizations	The theoretical arguments of the knowledge-based view, which considers knowledge creation as "an individual activity rather than an organizational activity".
1996	Spander	Environment - Organizations	A dynamic (rather than a static) knowledge-based theory of the firm. Knowledge is viewed as "a process or a competent goal-oriented activity rather than as an observable and transferable resource".
1996	Szulanski	Environment - Organizations	Adopting a communication metaphor in analyzing intra-firm transfer of best practice in a manner analogous to the transmission of a message from a source to a recipient within given media or context (Timbrell et al., 2001). While knowledge transfer is a distinct experience rather than diffusion, best practice transfer should be regarded as "a process rather than a transaction or event".

Source: authors' own study based on: Wahab S.A., Rose R., Ch., Uli J., Abdullah H., (2009), A Review on the Technology Transfer Models, Knowledge-Based and Organizational Learning Models on Technology Transfer, European Journal of Social Sciences – Volume 10, Number 4, pp. 550–564.

The interaction of business sectors and science institutions through the exchange of knowledge and technology has become a central concern not only for applied economics but also for economic policy in the last years (Mowery & Shane, 2002; Lockett et. al. 2005; o Goldfarb & Henrekson, 2003; Arvanitis, et.al. 2008). Table 3.2 presents the literature review of the models of the technology transfer based on the range of University and industry background.

French and Bell (1995) points out that in the late 1980s and early 1990s technology transfer (TT) models started to absorb the principles of the organization development movement. The literature review presented in the tables

Table 3.1. The Literature Review of the Technology Transfer (TT) Models – University-Industry perspective

Year	Author	Range	Key Factors of the Model	Methodology
2002	Mayer & Blass	University-industry	The model presents different approaches that can be used depending on the characteristics of the agents. The model describes the importance of a new actor that allows for "translating" the language spoken by the transmitter and receiver.	Qualitative (practical case)
2004	Rubiralta	University-industry	The model presents a system approach based on the triple helix, where the main agents are the university, as a creator of technology, the industry, as a receiver of technology, and the technology transfer office (TTO), as the intermediary agent that supports the transfer process.	Qualitative (conceptual model)
2006	Gorschek, Garre, Larsson, & Wohlin	University-industry	It is a model built from a particular case. It describes seven steps that should be taken to achieve technology transfer.	Qualitative (practical case)
2009	Hoffmann, Amal & Mais	University-company	The model posits that there are three levels that university research can offer: level of science, level of technology, and level of use. The transfer can occur at any level.	Qualitative (practical case)
2015	Kalnins & Jarohnovich	University-industry	The model posits that there is not only formal technological transfer, but also informal techno-logical transfer. The model is based on the fact that the university currently has the mission of helping the industry generate innovation.	Qualitative (conceptual model)
2018	Aranas & González	University-industry	The Technology Transfer conceptual model of university-industry collaboration (UIC). The process occurs within the UIC context, with social and political factors.	Qualitative (conceptual model)

Source: based on: Aranas J.J., González D., (2018), Technology Transfer Models and Elements in the University-Industry Collaboration, Adm. Sci. 2018, 8, 19; doi:10.3390/admsci8020019.

(Table 3.1 and Table 3.2) shows that phenomenon. Referring to Daghfous (2004), strategic management researchers have further contributed to the development of TT frameworks based on knowledge-based models and learning perspectives as these perspectives have been found to have quite similar dimensions such as outcomes, processes, barriers and facilitators.

3. Methodology

The in-depth interview is a technique designed to elicit a vivid picture of the participants' perspective on the research topic. The researcher's interviewing techniques are motivated by the desire to learn everything the participant can share about the research problematics. The in-depth interview is an effective qualitative method. Using it, the researcher can gain insight into how people interpret and order the world. (Milena, Dainora & Alin, 2008).

On the basis of the literature review presented in the previous part of this article, the authors formulated the following research questions:

1. What are the main barriers of the knowledge and technology transfer (KTT)?
1. What are the main motivators (facilitators) of the KTT?
2. Who are the main players in the KTT process?
3. What are the outcomes of the KTT process?

These questions were presented in the IDI as the semi-structured scenario.

The study covered entities of the economic ecosystem, with particular emphasis on the academic community, the interviewees were rectors of renowned Polish universities (Wrocław University of Economics, Wrocław University of Environmental and Life Sciences). In addition, opinions from other areas of the ecosystem, entities that are important in the transfer of knowledge and technology from the academic area to business, were considered important. In this context, an IDI was conducted with the Chancellor of the Business Center Club Lodge, the CEO of Zoo Wrocław sp. z o.o. and outstanding academics with significant achievements in the context of implementing their research into the economic space. The research was conducted from January 2021 to April 2021. The interviews lasted between 1.5 and 3.5 hours. In order to maintain the integrity of the qualitative research, the interlocutors were asked for their consent to record. Most agreed. Later in the research procedure, the recordings were transcribed and encoded. The interlocutors did not agree to have their names publicised – only positions.

4. Findings

Due to the variety of the economic system, the authors defined different parties within the research: knowledge and technology transfer catalyst – KTTC (Polish Universities representatives), knowledge and technology supporting units – KTTSU (BCC), knowledge and technology synergy hosts – KTTSH (Zoo Wroclaw CEO). All interlocutors expressed their views clearly, sharing their experience in the field of KTT. Referring to the barriers of the knowledge and technology transfer (KTT) the interlocutors defined a few, and they especially pointed out the knowledge level of the ecosystems parties (different for each of the parties), the leadership, the culture and the potential. The essence can be expressed in one of the citations of the (KTTSU) interlocutor:

The national economy is moderately knowledge and technology based. And the world yes, due to the position of leaders in this regard. We are talking about these producers, these thinkers, these creative activities that emerge from given environments, where there is an appropriate atmosphere, culture (…) we do not

use our potential due to the fact that we do not create culturally good conditions for the expression of our creative potentials (…) through the burden of all aspects of distrust, lack of trust, it is especially painful at the intersection of science and entrepreneurship, economy and business, because then nothing can replace this (…) this is one of the biggest brakes.

Another interlocutor (KTTC) said:

Traditionally – the majority of people focused on science are not related to business (…) Business is also more open to consulting companies than universities – business is not used to the fact that new useful knowledge can be obtained from universities (…) they create technologies on their own (…) At universities, time flows differently.

In the field of main motivators (facilitators) of the KTT, the interlocutors defined the information revolution (internet, social media, mobile trend), market development and the competitiveness of the global economy and knowledge/education development and especially the synergy effect:

Technology enables us to access information (…) technology is the future… tissue banks, gamete banks… (…) At the moment, technology forces many changes, changes in human behavior, changes in the allocation of free time, changes in the perception of the world and science and another interlocutor yet also said that *Our human potential is great. The university is a center for transferring people, not technology. If the company wants to develop, it has to be done there. Grants are a challenge. This is the best. We deliver much expertise, but this is a short-term operation. We are isolated from practice in the education process – this requires a lot of work. We work well on the CEO-Rector level, it looks worse lower.*

The interlocutors also pointed to the meaning of the R&D within the companies.

In the field of the main players of the KTT and the role of universities, the interlocutors said:

It is important to identify relationships with business and build common space, Universities are a place of the highest-quality research, inspired by business practice, The university is not eager to make technology. Today it's a matter of scoring. (…) if the university wants to be innovative, there must be a change in mentality and legal solutions – e.g. advance financing, and not "giving" own resources at the beginning. The scientists' responsibility must also change – they must be mature for entrepreneurship and management, or there must be proper conditions for them to link their research activities with the market. (…) We can teach students a lot, but if they do not participate in projects, or if the projects are not based on their innovations, it will be useless.

What are the outcomes of the KTT process? The answer to that question was very similar during all the Interviews, and it can be concluded that the main outcome is the synergy effect, although it was not very clear for the Interlocutors

to point out on which side (Universities or the business) are the development initiators, so as it was said during one of the interviews – "it is a perfect match – *perpetuum mobile* of the development".

5. Conclusion

As the researchers points out (Galvez et al., 2013), knowledge as a key element for the economic development of modern economies has for a long time been replaced by the concept of capital and labor as the main players in the economy (Eckl, 2012). However, the regions that will flourish in the globalized and knowledge-based economy of the 21st century will be those with the greatest knowledge assets (Goldstein & Glaser, 2012). Organizations in private and public sectors face many challenges due to the break-through of knowledge development and technology transformation. This revolutionary change of knowledge and technology has directly modified both individual and collective organizational behavior. Traditional organizational practices and thus peoples' expected and required skills – as an individual worker and a group member are no longer the same as before the beginning of the transformation. Knowledge and technology management and consequently the transfer is also a huge challenge for management, both within the university and business environment.

The conversion of university research into economic growth is vital for the future of many nations, especially nations of the developing world (Warren et al., 2008), of which Poland is a great example.

Studies, including systematic literature review, qualitative primary research and analysis of available secondary data revealed that the ability of dynamic enterprises and orientation knowledge of market operators and their network character impact positively on the effectiveness of technology and knowledge transfer from the university to the business, thus increasing the competitiveness of market entities.

The study shows that the problem of the diffusion of knowledge in the economic ecosystem (within the universities and business sector) is a very complex matter. The authors plan to deepen the research both in the context of methods (quantitative methods) and geographic area (comparison with highly developed markets) in the future.

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Formal Analysis of Application Areas
for Public Blockchain Networks

Daniel Wilusz

1. Introduction

Applications of blockchain solutions have been of great interest to both researchers and entrepreneurs for years. Lists of dozens of examples of potential blockchain applications have been created covering areas such as finance (Ali et al., 2020), public administration (Schulz, 2020), voting (Dunietz, 2018), legal contracts (Governatori, 2018), public documents (Jeong & Ahn, 2021), healthcare (Santos Rutschman, 2018), property access management (Singh et al., 2019), intangible assets (Zeilinger, 2016), energy sector (Wang et al., 2021) or the military (Ledra Capital, 2014).

Despite the wide range of potential applications, blockchain-based solutions have found practical use in only a few areas (electronic money systems, distributed virtual machines, and technology layer for blockchain external systems). The purpose of this paper is to identify the technical properties of public blockchain networks in order to substantiate their practical application areas. This paper presents the results of an interdisciplinary analysis from the fields of computer science and management science to assess the usefulness and application scope of public blockchain networks in organizations. In this paper, a formal model of a public blockchain network is presented to briefly define its properties. With concise definitions, it is possible to evaluate the extent to which the public blockchain network meets the requirements of management information systems. This paper demonstrates the thesis that, despite the limited practical area of application of public blockchain networks, they provide a sound foundation for blockchain external information systems. Blockchain external information systems take advantage of the immutability, transparency, and distributed control available in public blockchain networks to ensure consistency and control of the data stored in these systems (outside the public blockchain database).

The paper is organized as follows. In Section 2, the concept and properties of the public blockchain network are described. Section 3 demonstrates and discusses the practical application areas for public blockchain networks. Section 4 concludes the paper by pointing out the potential inherent in multilayered blockchain architecture.

2. The Concept and Properties of the Public Blockchain Network

To define a public blockchain network several basic concepts must be introduced. First, the basic data structure – blockchain – is explained. Next, the concept of a distributed blockchain database is described. Finally, the public blockchain network is defined and characterized.

2.1. Blockchain

There are many different definitions of blockchain in the literature resulting in an ambiguous understanding of this term. Blockchain is defined as broadly as a technology layer (Swan, 2015, p. 1), a ledger (Dhillon et al., 2017, p. 4), a tamper–proof data storage technology (Ferguson, 2018), a database (Raval, 2016, p. 2; Felin, T., & Lakhani, 2018, p. 34) or a data structure (Antonopoulos, 2017, p. 195; Madnick, 2019; Wilusz, 2020). For the purpose of this study, the definition combining the Bitcoin blockchain definition proposed by Antonopoulos (2017, p. 195) and the formal definition proposed by Wilusz (2020, p. 208) is adopted.

Blockchain is a back–linked list of data blocks in which the reference to a previous block depends on the content of the previous block[1]. The above property determines that any change of data (even one bit) in the previous block forces a change of the reference value in all next blocks. Moreover, each block can be used to verify the data consistency in previous blocks.
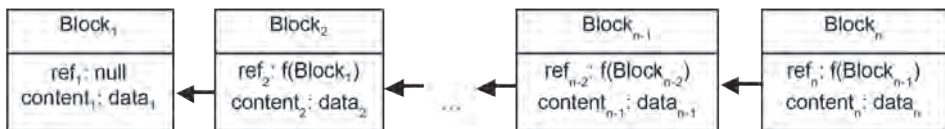
Figure 4.1. Model of Blockchain
Source: own work.

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[1] Usually a one-way compression function f is used to calculate the reference. A reference to the previous block in the Bitcoin block chain is calculated with SHA256 hash function (Antonopoulos, 2017, p. 197).

2.2. Distributed Blockchain Database System

Definition of the distributed blockchain database system requires introducing the concept of blockchain database, blockchain database system, distributed blockchain database system, heterogeneous distributed blockchain database system, and a consensus mechanism that ensures the consistency of the distributed blockchain database.

To define a blockchain database the general database definition provided by Elmasri & Navathe (2011, p. 4) is combined with the formal definition proposed by Wilusz (2020, p. 208). Blockchain database is a set of related data stored in the blockchain that reflects some aspects of the real world, includes logically coherent data, and exists for a specific purpose. The blockchain database shares the features of blockchain, which are self–verification, and the need to update links in the next blocks after making changes in any block except the last one. Blockchain databases along with the blockchain database management system form the blockchain database system. A blockchain database management system is a set of software[2] that enables comprehensive blockchain database management (Wilusz, 2020, p. 210).

The definition of a distributed blockchain database system is formed by adapting the definition of a distributed database system proposed by Connolly & Begg (2005, p. 689). A distributed blockchain database system consists of (1) a blockchain database that is divided into fragments and (2) numerous database nodes that store one or more fragments of the blockchain database, run database management systems, and communicate with each other over a computer network.

Depending on whether the database management systems used in the distributed database system are the same product or whether multiple products are allowed, we distinguish between homogeneous distributed database systems and heterogeneous database systems, respectively (Connolly & Begg, 2005, p. 697). In heterogeneous distributed blockchain database system different database management systems can be applied to manage the blockchain database and the underlying data model used by these database management systems may also differ.

If there are discrepancies within the data stored by the database nodes, the distributed database becomes inconsistent (Fekete, 2018). In a consistent distributed blockchain database the sum of the fragments from all nodes produces a valid blockchain database. In a valid blockchain database, for each block

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[2]   The Geth (Go Ethereum, n.d.) and Parity (Parity Technologies, 2020) are examples of a blockchain database management systems managing Ethereum databases.

(except for the first one), only the one previous block can be pointed to by using a reference contained in the block.

Due to the numerous data sent simultaneously to different nodes, blockchain database nodes must agree on the content of each new block attached to the blockchain to maintain the consistency of the database (Singhal et al., 2018, p. 130). Reaching an agreement on a newly appended block by the blockchain database nodes is enabled by using a consensus mechanism. Distributed blockchain database systems use various consensus mechanisms (e.g. proofofauthority, proofofstake, proofofwork). For distributed blockchain databases where at least a few nodes are trusted, proof of authority mechanism can be used. With proof of authority, a new block is appended to the blockchain by one of the trusted nodes (Binance Academy, 2020). In general, verifying the correctness of a newly appended block involves checking the digital signature that was included in the appended block by the trusted node.

In most applications of public distributed blockchain databases, nodes do not trust each other. In this case, the consensus mechanism must require some form of commitment (e.g. money, computing power, computer memory) from the node attaching the new block in order to discourage the node from approving an incorrect block. Examples of such mechanisms are proofofwork and proofofstake. Proofofwork is a consensus mechanism that requires a certain amount of work to be done before a new block is attached to the blockchain (Singhal et al., 2018, pp. 131–133). In a distributed blockchain database system, a work verification mechanism should be defined to verify that work has been done on a block before attaching it to the blockchain. Proofofstake is a consensus mechanism that elects the blockchain database node attaching the new block and requires the elected node to risk a certain stake (e.g. money) if a block attached by that node to the blockchain leads to a database inconsistency (Antonopoulos & Wood, 2018, pp. 320–321; Dhillon et al., 2017, p. 14; Singhal et al., 2018, pp. 133–134).

A heterogeneous distributed blockchain database system satisfies the following objectives for distributed database systems that were defined by Date (2004, pp. 651–660):

- Local autonomy – all operations at a given blockchain database node are controlled by that node, but the node must follow consensus rules to maintain the consistency of the blockchain database;
- No reliance on a central site – there are no central services in the heterogeneous distributed blockchain database system and database nodes are treated as equals;

■ Continuous operation – in case of disconnection or failure of some database nodes, the heterogeneous distributed blockchain database system is still available;

■ Location independence – data stored in the heterogeneous distributed blockchain database system can be easily migrated from one location to another;

■ Fragmentation independence – in the heterogeneous distributed blockchain database system distinct data pieces can be stored in different fragments in different locations by different nodes;

■ Replication independence – in the heterogeneous distributed blockchain database system a given fragment can be stored in many distinct copies by many nodes;

■ Distributed transaction management – the consensus mechanism causes that only the transactions included in the newly appended block can be entered into the distributed blockchain database, while other transactions are discarded but can still be included in the next blocks. Furthermore, the consensus mechanism prevents changes to data in already attached blocks, so changes are made by correcting entries just like in an accounting system;

■ Hardware independence – blockchain nodes can run on a variety of hardware such as laptop, server, virtual machine, smartphone, and dedicated FPGA – Field Programmable Gate Array (ASICs, L. 2019);

■ Operating system independence – blockchain nodes can run on different operating systems or even without operating systems (dedicated FPGA);

■ Network independence – a heterogeneous distributed blockchain database system uses internet to exchange data between nodes;

■ Database management system independence – a heterogeneous blockchain distributed database system is, by definition, independent of the specific implementation of the database management system.

By fulfilling the above objectives, heterogeneous distributed blockchain databases provide such advantages as efficiency, productivity, convenience, and reliability (Foster & Godbole, 2016, p. 362–263). However, for some implementations of heterogeneous blockchain database systems, the overhead required to reach consensus can cause issues concerning performance or costs.

2.3. Public Blockchain Network

A blockchain network is formed by database nodes that share a heterogeneous distributed blockchain database and communicate with each other. For the purposes of this paper, we will define a public blockchain network as a collection of nodes communicating with each other and storing fragments of a blockchain

database, where any entity with the appropriate software and network connectivity can anonymously join this network[3], read all data contained in the blockchain, and request the addition of new data to the blockchain. The public blockchain network definition identifies its four main features: transparency, distributed control, anonymity, and immutability (Madnick, 2019; Tucker & Catalani 2019).

In general, databases enable four basic actions on data, that are: create, read, update, delete (Martin, 1983, p. 381). However, in public distributed blockchain databases, the consensus mechanism prevents data changes in already attached blocks (immutability), which disables the execution of a data delete action and restricts the data update action to the application of correcting entries only.

From a security perspective, a database system should be protected against the following threats: loss of data integrity, loss of data availability, and loss of data confidentiality (Elmasri & Navathe, 2011, p. 836). In a public blockchain database system, integrity protection is provided by a consensus mechanism (immutability, distributed control), a large number of nodes in the network and a large number of block copies distributed among these nodes (distributed control) which protect against data unavailability. However, an unsolvable problem is protecting the confidentiality of the data contained in the blocks since, by definition, this data is available to any entity that joins the network (transparency).

3. Application Areas for Public Blockchain Networks

Due to their characteristics (transparency, distributed control, anonymity, immutability, integrity, availability), the application of public blockchain networks is limited to specific purposes (in particular, those where data confidentiality is not necessary). In practice, the public blockchain network has been applied to the implementation of electronic money systems, distributed virtual machines, and the foundation for multi-layer systems.

3.1. Electronic Money Systems

The features of public blockchain networks enable the implementation of electronic money systems that have most of the properties of non–state electronic money systems. Blockchain enables the following requirements for private electronic money systems mentioned in the paper by Matonis (1995):

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[3]   Typically, a blockchain network adopts a peer-to-peer network structure in which all nodes have identical privileges. Examples of such a network are the Bitcoin network and the Ethereum network (Antonopoulos, A.M., 2017, p. 171; Antonopoulos & Wood, 2018, p. 123).

- Security – distributed control over the data stored in the public blockchain database, its immutability and transparency prevents counterfeiting and double spending of electronic money;
- Anonymity – nodes in a public blockchain network are anonymous by definition;
- Portability – the electronic money in a public distributed blockchain database is just data that can be accessed by any device accessing the public distributed blockchain network, regardless of the physical location of a device having access to the public blockchain network;
- Bi-direction – electronic money stored in the public blockchain database can be both spent and accepted by any blockchain node;
- Divisibility – electronic money stored in the public blockchain database can be spent in as small amounts as needed;
- Infinite duration – there is no expiration date for electronic money stored in a public blockchain database;
- Free unit of value – public blockchain database enables denomination of electronic money in the market–determined, non–political monetary units. In addition, each node can use blockchain as a ledger to issue electronic money denominated in its own units.

Public blockchain networks have been widely used in practice as a tool for issuing electronic money (called cryptocurrency) and settling financial transactions. As of early 2021, there are more than four thousand cryptocurrencies (De Best, 2021). However, due to the technical details of electronic money implementation, these systems experience problems related to the speed of payment transactions, the maximum volume of transactions (Chauhan et al. 2018), or the costs of executing such transactions (Michelman, 2017).

3.2. Distributed Virtual Machine

A public distributed blockchain database has found application as a storage for the distributed virtual machine[4] state, thus acting as a storage for public distributed virtual computer. As result, the machine code executed by the nodes in the public blockchain network causes a change in the state of the virtual state machine, which is stored in the blockchain database. Due to the transparency of the public distributed blockchain database, any node in the public blockchain network can access the current state of the virtual machine and all historical states. Due to distributed control of the public distributed blockchain database,

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[4] The ethereum virtual machine (EVM) is an example of distributed virtual machine working with blockchain database (Antonopoulos & Wood, 2018, p. 297–318).

any node can execute machine code and save the new machine state in the blockchain database. The above–mentioned properties of the virtual machine make it possible to implement distributed information systems. The code of a computer system stored in a blockchain database may include a set of rules, particularly rules that specify conditions for running that code, thus limiting the code execution right to a specified set of nodes. However, what must be stressed out is the fact that the data stored by these systems are publicly available, therefore these systems do not ensure data confidentiality, which significantly limits the scope of their application in practice.

3.3. Blockchain Layer One

The public blockchain network can serve as a foundation (layer 1) for building external systems (layer 2). Such external systems use the public blockchain network to maintain data immutability, but lack the immanent features of the public blockchain network (e.g. transparency, anonymity, distributed control) or solve performance issues (e.g. lack of scalability, high cost of operation) (Dienes, 2020). The blockchain layer 2 solutions are classified into the following categories (Wackerow, 2021):

- Rollups – solutions that perform code execution outside blockchain network, but stores the result data in public distributed blockchain database;
- Channels – solutions that execute code multiple times outside blockchain network, but store only two state changes in the public distributed blockchain database[5];
- Plasma – separate blockchains that use a public blockchain network to achieve consensus;
- Sidechains – separate blockchains that run their own consensus algorithm and only exchange data with the public blockchain network.

Layer two blockchain solutions enable the implementation of business information systems that require high performance, data access control, data confidentiality, user identity management, and that cannot be implemented in a public blockchain network.

4. Conclusion

The inherent characteristics of public blockchain networks, such as immutability, transparency, distributed control, and anonymity, make the practical ap-

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[5] The bitcoin lightning network is an example of a dedicated payment channel operating on top of the bitcoin network (Poon & Dryja, 2016).

plications of these networks very limited. Public blockchain networks considered as stand–alone information systems can be used to implement a narrow range of specific solutions, such as electronic money systems or distributed virtual machines. However, when applying multi–layered architecture that combines layer one public blockchain networks (providing immutability, transparency, and distributed control factors) with layer two external systems (enabling data confidentiality, strict control of user access rights, or high computational efficiency), a wide application area can be covered.

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Forecasting Accuracy Evaluation of Deep Recurrent Networks

Jakub Michańków

1. Introduction

The main goal of this paper is to assess and evaluate forecasting accuracy of selected recurrent deep neural networks, based on the hypothesis that these types of networks can be successfully used to provide point forecasts of stock returns. The focus is on model prediction accuracy when working with financial time series data, mainly logarithmic stock market returns. Several types of deep recurrent networks are tested, with an emphasis on recurrent neural networks (RNN), long short-term memory networks (LSTM) and gated recurrent unit (GRU) networks.

It is also believed that according to the efficient market hypothesis (Fama, 1970), the market's prices reflect all available information, implicating that it is not possible to "beat the market", or to predict the stock prices or return's movements. Following this assumption, several different data sets were selected, based on MSCI Market Classification, representing both developed economies (with strong market efficiency) and emerging/frontier economies (with weak, or semi-strong efficiency). It is assumed that methods used in this research would produce better results when predicting data from less efficient markets.

The methodology used in this paper is based on deep recurrent neural networks. Recurrent networks are a type of neural nets that are widely used when working with sequential data, such as time series. The typical network architecture consists of one or more recurrent layers, one or more densely connected layers and one output layer with a number of hidden units (neurons) that is equal to the number of desired network outputs. A large part of the work has been put into the appropriate selection of network hyperparameters and data preparation. Network predictive performance is assessed based on one-step ahead prediction of logarithmic stock returns. The mean squared error (MSE) and mean absolute

error (MAE) measures are used to evaluate prediction errors of specific models, which are then compared against each other.

The problem of predicting financial time series using deep learning methods has been widely described in the literature, especially since these methods have become more popular in recent years. While many articles focus on predicting stock prices, stock returns are considered a better object of study, since they are usually stationary.

Zhang *et al*. (2018) used LSTM networks to predict stock returns of CSI300 index to create a multi factor stock selection model which was then implemented to build an investment strategy. Their results showed that LSTM network achieved just over 50% accuracy on out-of-sample data. Di Persio and Honchar (2016) compared several types of neural networks, including LSTM networks, to predict directional stock movements of the S&P500 index, with RNN model accuracy achieving around 52% success. Hansson (2017) used LSTM networks to predict stock returns of several selected indices, with the results showing that these networks performed better on less efficient markets, such as the Swedish OMX30 index. Nguyen and Yoon combined LSTM networks with transfer learning methodology to predict short term price movement with a deep transfer model. Their results showed 50–55% accuracy across several Korean and US stock companies. Chong *et al*. (2017) used deep neural networks to predict stock returns of 38 companies listed on the Korean KOSPI index, and compared the result with an autoregressive model. Results showed that DNN networks performed similarly to an AR model, but the prediction results improved when DNNs were applied to residuals of an AR model. Fischer and Krauss (2018) applied LSTM networks to predict directional movements of the S&P500 index, and compared the results with other machine learning-based methods, such as memory free models and random forests. The results showed that LSTMS outperform other researched methods with daily returns of 0.46%. Similar research can be found in various other scientific papers, including, but not limited to, works by Chen *et al*. (2015), Zhong and Enke (2019), Qiu *et al*. (2016), Chiang *et al*. (2016) or Kim and Won (2018).

2. Methodology

The research focuses on logarithmic stock returns, that can be described as follows:

$$r_t = ln\left(\frac{P_t}{P_{t-1}}\right), \tag{1}$$

where is a price of the financial instrument at time *t*.

The main tool used in this work to predict the stocks returns are deep neural networks, specifically recurrent neural networks. Three main types of recurrent networks that are tested in this research are simple recurrent neural networks (RNN), gated recurrent unit (GRU) and LSTM networks.

RNN networks, consisting mostly of simple RNN layers, are representing a basic recurrent neural network architecture. Neurons in recurrent networks are able to model sequential data by storing the information about past relations between the data periods that could be described as:

$$h_t = f(x_t, x_{t-1}, \ldots, x_1), \tag{2}$$

where is an input vector at time t.

However, the information from longer periods of time tend to vanish over time, causing a problem with the optimization process, where weights of the network are multiplied by itself many times, causing the gradient to either vanish or explode (Goodfellow *et al.*, 2016, p 398).

LSTM networks were introduced by Hochreiter and Schmidhuber (1997) as a solution to the vanishing gradient problem. They introduced a cell state to create a specific self-loop, which can be updated dynamically, and allows the gradient to flow for a long duration of time. The architecture of this kind of network consists of three gates: forget, input and output gate. These gates, by using sigmoid and tanh activation functions, control the self-loop, ultimately deciding which information should be stored and which forgotten by the network. The architecture of LSTM can be described as follows:

$$f_t = \sigma(U_f x_t + V_f h_{t-1} + b_f), \tag{3}$$

$$C'_t = f_t \circ C_{t-1}, \tag{4}$$

$$i_t = \sigma(U_i x_t + V_i h_{t-1} + b_i), \tag{5}$$

$$C_t^+ = tanh(U_c x_t + V_c h_{t-1} + b_c), \tag{6}$$

$$o_t = \sigma(U_o x_t + V_o h_{t-1} + b_o), \tag{7}$$

$$h_t = o_t \circ tanh(C_t), \tag{8}$$

where and are activation vectors for three specific gates, is a hidden state (or output) vector, is a cell state vector, while and denote biases, input weights and recurrent weights of the network cells.

The third type of recurrent networks, the GRU networks (Chung *et al.*, 2014) were introduced as a simpler version of LSTM networks. Instead of using three separate gates to update the network state, they use a single unit to forget the information or update the network state:

$$h_i^{(t)} = u_i^{(t-1)} h_i^{(t-1)} + (1 - u_i^{(t-1)}) \sigma(b_i + \sum_j U_{i,j} x_j^{(t)} + \sum_j W_{i,j} r_j^{(t-1)} h_j^{(t-1)}), \quad (9)$$

$$u_i^{(t)} = \sigma(b_i^{(u)} + \sum_j U_{i,j}^{(u)} x_j^{(t)} + \sum_j W_{i,j}^{(u)} h_j^{(t)}, \quad (10)$$

$$r_i^{(t)} = \sigma(b_i^{(r)} + \sum_j U_{i,j}^{(r)} x_j^{(t)} + \sum_j W_{i,j}^{(r)} h_j^{(t)}, \quad (11)$$

where u represents the update gate and r the reset gate.

Training with these networks usually results in a faster computation during the training process, but the results show that these types of networks are usually very close to LSTMs (Greff *et al.*, 2015), while LSTM networks are the most widely used type of deep recurrent networks and are considered the best of all types of recurrent nets (Goodfellow *et al.*, 2016, p 408).

Networks used in this experiment were created using three sets of recurrent layers, where the first layer had 256 neurons, second 128 neurons and the third one 64 neurons. The last layer in the network architecture was a dense type layer with a single output (neuron) and a linear activation function. Networks were programmed using python programming language, while the two main libraries used to code the networks were tensorflow with Keras as an API. Networks were trained on 120 epochs, using a rolling window of 252 days to forecast one step into the future, on a GPU with 272 tensor cores. Cores of this type are significantly faster in machine learning tasks, which in turn allowed for a much faster computation time.

Very important step while creating any deep neural network architecture is setting the proper hyperparameter values. In this case, hyperparameters were initially chosen based on the heuristic values from the literature, and then carefully tuned to maximize the network predictive performance.

One of the most important hyperparameters is the dropout, which defines how many random neuros should be skipped during the network training process. A lower dropout rate gives better results during training, but may lead to overfitting. As the initial value a low value of 0.001 was chosen, but after the tuning process it was increased to 0.2. This change resulted in smoother training and validation lines and better general prediction results. Dropout was added to each of the three recurrent layers of the network. Additionally, L2 regularization was introduced as a kernel regularizer of the second layer of each of the networks. This type of layer regularization applies penalties on layer parameters during the

training process. After initial tuning the value of this hyperparameter was set to 0.001.

The next decision when selecting hyperparameters is to choose the network optimizer. In this case, Adam optimizer was used. First proposed by Kingma *et al.* (2014), this optimizer is based on stochastic gradient descent which uses adaptive optimization of first and second order moments. Optimizer learning rate defines how much the weights are changed during the gradient descent optimization. During the training process, a learning rate scheduler was implemented, to ensure that the learning rate was lowered as the training progressed by applying an exponential decay function to an optimizer.

The forecasted results were compared to actual results and evaluated using two main error metrics – MSE (mean squared error) and MAE (mean absolute error), which can be written as follows:

$$MAE = \frac{\sum_{i=1}^{n} \left| Y_i - \hat{Y}_i \right|}{n}, \qquad (12)$$

$$MSE = \frac{1}{n} \sum_{i=1}^{n} \left(Y_i - \hat{Y}_i \right)^2, \qquad (13)$$

where are observed values and are predicted values.

Both of these metrics were also used as loss functions for network training. Additionally, a modified version of MSE was used as a loss function to compare predictions of directional movements of stock returns. It was modified in such a way, that when the network made a prediction with the wrong sign, it was penalized by multiplying the loss value by a selected value (in this case by 10). This way the network could predict directional movements better than just by using standard error metric, which doesn't take direction into account.

3. Data

To train and test the models, daily logarithmic returns from January 2000 until December 2020 were used. Data was split into train and test sets, where the train set consisted of 4032 observations and the test set had 1008 observations. Additionally, a validation set was dynamically created as a third of the train set. Datasets were also normalized to [–1,1] values, using min-max scaling formula:

$$x' = a + \frac{(x - min(x))(b - a)}{max(x) - min(x)}. \qquad (14)$$

Since our datasets have slightly different distributions, error metrics between data sets are not directly comparable. Loss function used for directional

predictions was adjusted so that it operated on zero value after the normalization, while directional predictions were made on inverted (denormalized) data.

A total of eight datasets were selected, where seven have been stock indices and one was a stock company. Indices were selected according to MSCI Market Classification, in such a way that they represent economies in different stages of development. From the developed economies, the US S&P500 index and Swedish OMXS index were selected. Polish WIG20, Argentinian MRV, Brazilian BVX, Estonian OMXT and Philippines PSEI indices were selected to represent emerging markets. OMXT index from Estonia represents the frontier market. As a stock company Polish CDR stock was selected.

This wide range of datasets allowed comparing network results between countries and economies with completely different characteristics and efficiency, which was one of the goals of this paper.

4. Empirical results

Each network was trained and evaluated on each of the dataset separately, so that the weights were reset after working on a specific dataset. The results shown in Table 5.1 represent how each of the tested network architectures performed on each of the datasets selected from emerging markets.

Table 5.1. Evaluation of RNNs across emerging and frontier markets

Network type	MAE	MSE	Direction %
PSEI			
SimpleRNN	0.0599	0.0075	50.8%
GRU	0.0591	0.0075	50.09%
LSTM	0.0589	0.0074	49.45%
OMXT			
SimpleRNN	0.0416	0.0051	52.23%
GRU	0.0400	0.0049	51.81%
LSTM	0.0399	0.0049	54.72%
BVP			
SimpleRNN	0.0913	0.0185	52.48%
GRU	0.0892	0.0184	51.90
LSTM	0.0888	0.0183	54.09%
MRV			
SimpleRNN	0.1193	0.0340	53.72%
GRU	0.1189	0.0339	55.18%
LSTM	0.1187	0.0339	55.45%

Table 5.1. cnt'd

Network type	MAE	MSE	Direction %
WIG20			
SimpleRNN	0.1138	0.0257	49.81%
GRU	0.1111	0.0250	46.18%
LSTM	0.1113	0.0250	51.72%

Source: own work.

The results of network performance error metrics should be directly compared across a single dataset, as each dataset has a slightly different distribution, resulting in different MAE and MSE values. Directional prediction results can be compared across all the datasets. When comparing MAE and MSE metrics, LSTM networks usually performed best, closely followed by GRU networks, while SimpleRNN architecture had the highest error rate. However, when looking at directional results, it can be noted that Simple RNN networks outperformed GRU networks, with LSTM having the best result.

Table 5.2 represents results of RNN architecture when trained and evaluated on datasets from developed markets. Additionally, results obtained when working with data from publicly traded company (CDR) were also presented here.

Table 5.2. Evaluation of RNNs across developed markets and public companies

Network type	MAE	MSE	Direction %
OMXS			
SimpleRNN	0.0878	0.0163	53.18%
GRU	0.0879	0.0164	52.36%
LSTM	0.0884	0.0165	52.72%
S&P500			
SimpleRNN	0.0647	0.0132	49.70%
GRU	0.0647	0.0134	50.09%
LSTM	0.0646	0.0130	50.90%
CDR			
SimpleRNN	0.0408	0.0031	45.36%
GRU	0.0422	0.0033	44.18%
LSTM	0.0414	0.0032	45.27%

Source: own work.

Network performance results presented in Table 4.2 show that both directional and error metrics results were much closer, and did not improve much

when using different network architectures. Interestingly, in this case, SimpleRNN networks had best results, while GRU networks had the highest error rates and lowest directional prediction accuracy.

5. Conclusions

Based on the results presented above, it can be concluded that there are slight differences between recurrent neural network types when working with stock returns data. The differences in both MAE and MSE error metrics are small, but consistent across all the datasets. From the trained network types, LSTM networks tend to have best results on most of the datasets. GRU networks are usually quite close behind, while SimpleRNN networks tend to perform the worst. The biggest difference in MAE between LSTM/GRU networks and SimpleRNN can be seen when working with indices from emerging and frontier economies.

In terms of direction predictions, LSTM also tend to have best results, while SimpleRNNs slightly outperform GRU networks. However, it should be noted that directional predictions were not the target of the network performance when minimizing the MAE and MSE loss functions, and were used as additional performance indicators that would allow comparison between different data sets. Lower error metrics values do not always translate into better directional prediction results, as can be seen in the results presented in Tables 4.1 and 4.2. This problem is caused by how error metrics are constructed as they do not take the direction (sign) of prediction into account. This problem was improved by slightly adjusting the MSE loss function, which allowed using directional prediction performance to compare results between different datasets. When comparing directional predictions, recurrent networks had the best results when predicting smaller, less effective, markets. Especially the OMXT, BVP, MRV and OMXS indices had the highest percentage prediction rate, while SNP500, WIG20 and PSEI had slightly lower scores, oscillating around 50%, which would indicate that the networks did not do very well in these cases. As for single company stock returns, CDR, all the networks failed to predict directional movements, with scores around 45%.

While the results presented in this paper are promising, using deep recurrent neural networks for time series forecasting could still be improved by using solutions that would improve the problematic areas. One of the problems encountered was that the typical error metrics, such as MAE and MSE, are not very good at predicting directional movement, while existing tools used to predict the direction of change, such as MDA (mean directional accuracy) or classification methods based on cross-entropy, do not account for the strength of the

movement. Creating a specific error metric that could be used as a loss function to properly evaluate both the direction and strength of the movements, could potentially improve the network predictive power. It also seems that while the point forecasts of stock returns are not very good, it might be beneficial to use probability forecasts instead.

While working on this research it was also noted that networks reflected increased volatility periods quite well, so it might be beneficial for further research to focus on volatility and risk forecasting. This could be achieved by creating hybrid models, combining recurrent neural networks with other types of deep learning networks, and volatility models, such as GARCH or SV models for further research. Deep learning networks work also very well with multiple features, so adding additional features to the network, such as trading volume, macroeconomic data or specific currencies or commodities data could improve the predictive performance.

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Customer Experience in E-Business

Marcin Szplit

1. Introduction

The article is based on several years of experience in observation of customer relationship management in selected enterprises. The research trail comes from companies that are active in e-trade and e-service. The aim of the research was to show differences between new marketing tools based on data base analysis in comparison to well-known Customer Relationship Management. It is noticeable that companies use new business models based on Customer Data Platforms rather than the old fashioned Customer Relationship Management. According to research conducted by McKinsey, as many as 76% of consumers have changed their purchasing habits because of the pandemic. Moreover, we have found ourselves in a world where cookies go away forgotten, and the third-party data is no longer useful.

While marketers face new related challenges with delivering personalized customer experience, CRM systems do not provide the right tools to deal with these challenges. Customer Data platforms turn out to be the best way out of this situation.

2. Customer Journey

Customers do not think in terms of singular interactions. They view their relationship with a brand as a product of their experiences. In fact, 90 percent of "customer experience decision makers" say a good experience is critical to their success (Pulido, Stone & Strevel, 2014). There are some critical factors diminishing a positive customer experience:

- Inconsistency in meeting even the basic customer needs.
- Lack of clear policies and mechanisms to ensure service/product delivery during an interaction.
- Disenchantment with brand/lack of consumer confidence.

- Breakdown in communication.
- Failure to deliver on promises.

If enterprises fail to see things from their customers' perspective, this leads to attrition risk, increased disaffection, and inhibits the acquisition of new customers. Companies need a way to assess potential problems before they get out of hand. To create such an experience, the company needs to create customer journey mapping. It can help rebuild the customer experience by doing the following:

- Revealing friction points or stressors (service, product, or process).
- Meeting customer expectations at key points in time.
- Clarifying inter-department handoff points.
- Defining new segments and personas.
- Enabling the alignment or realignment with brand identity.
- Facilitating resource planning and allocation.

Acting on the insights of the customer journey strengthens customer satisfaction, which measures how well you executed a particular action or process and can lower the cost of serving customers by as much as 20 percent. (Ramanujam, 2017) According to McKinsey, customer journey satisfaction was 30 percent more predictive of overall customer satisfaction than measures of satisfaction for each individual interaction. In other words, the overall journey has more impact on satisfaction than each individual interaction.

The customer journey is not a new concept, but it may just improve your customer experience. An example of Customer Journey introduced in IKEA is shown in Figure 6.1.
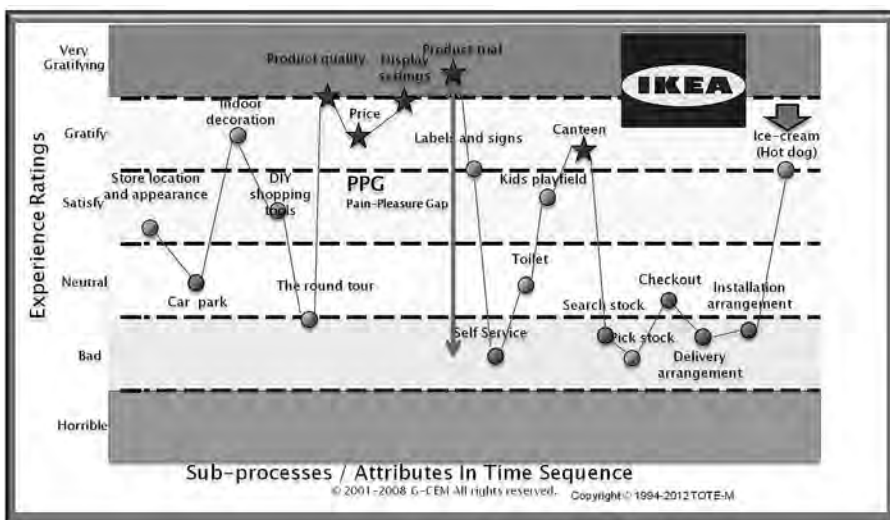
Figure 6.1. Customer Journey Map in IKEA

Source: https://ccnews.pl/2017/11/26/5-ciekawych-map-podrozy-klienta/.

3. Customer Experience

Customer expectations are gaining momentum from year to year. Contemporary consumers increasingly often want (consciously or not) to buy the positive experience they expect from contact with a selected product/service. As if that was not enough, the consumer also pays for the values to which he aspires and which he associates with a given brand.

This global trend is also confirmed by the results of research carried out on the domestic market. According to PwC (PwC, 2018) data, the dominant trend in consumer behavior in recent years has been convenience, i.e., the pursuit of the greatest convenience and time savings. 46% of Poles are actively looking for ways to make their lives easier, and 36% are ready to pay more for products that make life easier (GfK, 2017).

According to MorrisMarlowe (MorrisMarlowe, 2013), 89% of marketers employed in Polish enterprises believe that marketing research deepens knowledge about potential and real customers companies, but only 12% of companies have ever commissioned such a service. Marketers are convinced that knowledge about customers is extremely important, although they perceive themselves as those who know the world of consumers best.

Still one of the most common marketing tactics is pricing. Many manufacturers and suppliers assume that the best price for their products is the lowest, because the low price is supposed to attract the attention of customers.

From the Digital Customer report (KPMG, 2019), we learn that values such as credibility and personalization currently have the greatest impact on customer opinions about brands. In short – the credibility of a brand lies in the consistent implementation of its promises. Personalization, on the other hand, refers to the ability to understand the individual needs of the client and provide him with a product or service in line with specific expectations. In the crowd of consumers, we do not want to remain impersonal and meaningless.

Recent years have seen a significant increase in the importance of the personalization pillar (KPMG, 2017). According to the analysts (the above-mentioned), it is the result of the maturity of the Polish consumer on the one hand, and on the other – the effect of interaction with the digital world, which guarantees ever better adjustment to individual preferences. Customers experiencing advanced personalization offered by digital service providers are transferring their expectations of brands to other areas (including offline).

The ongoing digital transformation is changing our current purchasing habits in various ways. Distance loses its importance, wide choice (high market competitiveness) directly translates into a decline in brand loyalty.

4. Customer Relationship Management is Not Good Enough.

According to the Boston Consulting Group, (BCG, 2020) the question of how many times more expensive it is to find new customers than to keep the ones the company already has is best answered by a comparison showing that it costs $6.80 to market to existing customers via the Web versus $34 it costs to acquire a new Web customer. The calculation is made in the following way:

- It costs e-commerce companies, on average, $250 in marketing and advertising costs to acquire one customer.
- The gross income from the aforesaid typical customer (after operating costs are deducted) is a paltry $24.50 in the first quarter – but $52.50 in every succeeding quarter that she stays with the company.
- Close to 65 percent of all online customers never make repeat purchases.

Customers Expect Unified Marketing, Sales, and Service Interactions. The exact numbers are shown in Table 6.1.

Table 6.1. Percentage of customers who say the following are very important to winning their custom

Customer expectations	Percentage of responses
Salespeople's awareness of service interactions	73
Salespeople's awareness of marketing campaigns/offers	71
Service agents' awareness of sales interactions	70
Consistency across channels	70
Tailored engagement based on past interactions	59

Source: State of the Connected Customer survey, Salesforce Research, April 2018.

From the data collected in Table 4.1, it follows that the most important factors are mostly those based on contacts between customers and salespeople.

If a customers have even one seamless, connected experience, their knowledge of what is possible — and thus their standards — are forever raised. This is true even if such experiences are not the norm, and the result is a customer base that expects more.

Customers express frustration with lack of connections across their journeys, from the 54% who crave more relevant marketing messages to the 63% who want easier and faster customer service. A mere 16% of customers rate companies as excellent at providing consistency across channels, and only 15% say that companies are excellent at tailoring engagement based on past interactions. (Salesforce Research, 2018).

This is not a trivial matter for brands; customers respond to subpar experiences by taking their business elsewhere. 57% of customers have stopped buying

from a company because a competitor provided a better experience (Salesforce Research, 2018). Table 6.2 and Figure 6.2 show the results of research into customer experience and the best practice to create better customer journey.

Table 6.2. Customer Journeys Remain Disconnected

Percentage of customers who agree with the following:		Percentage of customers who rate companies as excellent at the following	
Customer service isn't as easy and fast as I'd like	63%	Delivering connected experiences	16%
Salespeople aren't as knowledgeable as I'd like	59%	Providing consistency across channels	16%
Marketing messages aren't as relevant as I'd like	54%	Tailoring engagement based on past interactions	15%
Shopping isn't as seamless as I'd like	48%		

Source: State of the Connected Customer survey, Salesforce Research, April 2018.
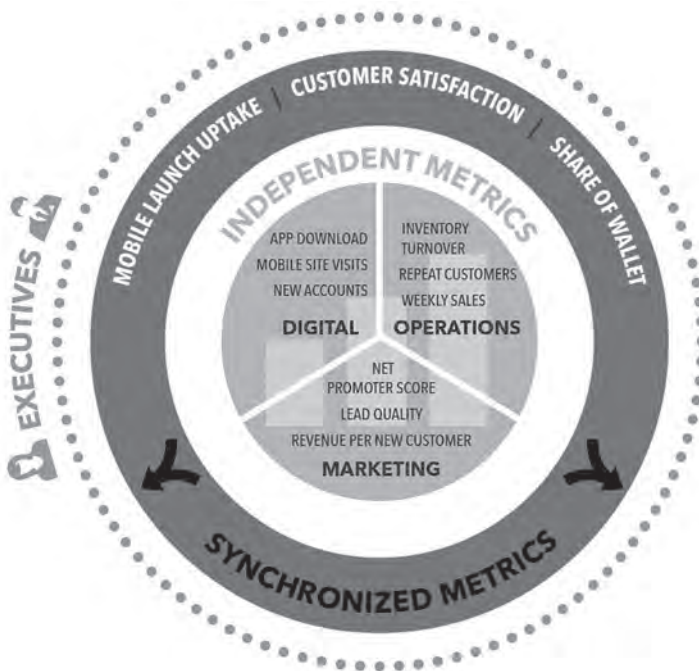
Figure 6.2. After campaign synchronization
Source: Analytics & Customer Journey. 7 best practices for delivering a better customer experience. SAS Best Practices White Paper, p. 13.

From the data analysis in the Table 6.2 it follows that there is a huge difference between customers' opinions about companies and companies' opinions about themselves.

The advantage of all this new data and information is that it offers an opportunity to expand on how to conduct business and measure success. Common metrics include customer sentiment or satisfaction scores, explicit activities (abandoned web page, time on hold, time on site), and outcomes (social interactions, return visits, social reach, churn).

In the process of mapping the journey, it is possible to find that the outcomes will shift, which implies some of the corresponding metrics will change as well. This leads to another critical point. Adopting shared metrics is necessary for enforcing and encouraging interdepartmental collaboration.

5. E-Business Context of Customer Experience

One of the most popular tools that companies use to manage customer experience is the Net Promoter Score. The Net Promoter Score is a tool created by Fred Reichheld, being the result of his many years of research on the accuracy of consumer satisfaction surveys. NPS is a short and synthetic tool. It focuses on customer involvement in the brand in question using a 0–10 scale: How likely is it that you would recommend (brand) to a friend or colleague?

Subtracting the percentage of Detractors from the percentage of Promoters yields the Net Promoter Score, which can range from a low of –100 (if every customer is a Detractor) to a high of 100 (if every customer is a Promoter).

This indicator assumes that customers of each company can be divided into 3 types: promoters – brand enthusiasts, committed, active, regularly making purchases and encouraging their friends to do the same. The second category of clients is the so-called passives – satisfied with the brand, but uninvolved and willing to leave in the event of, in their opinion, a better offer on the market. The last group are the detractors – dissatisfied customers, passing negative opinions about the brand to their relatives/friends/network. The model is shown in Figure 6.3.
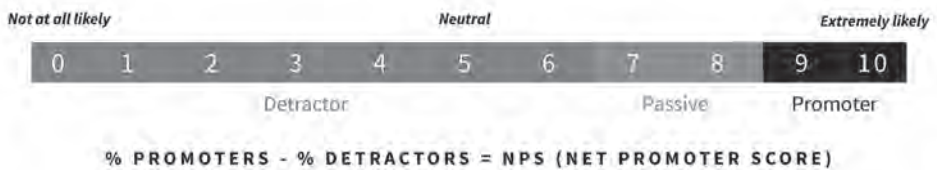
Figure 6.3. The NPS Calculation
Source: https://www.netpromoter.com/know/.

The model is based on the thesis confirmed by research (Reichheld, 2006) that:

- the cost of keeping the current customer is many times lower than the cost of acquiring a new customer,
- customers who come to the brand on recommendation represent the highest economic value in terms of statistics. They also have a greater tendency to become advocates themselves, which further winds up a favorable spiral of commands.

There are two main issues with using NPS:

- NPS is not a tool that allows you to gain in-depth knowledge about customers.
- So called "transactional NPS" (NPS survey relating to the customer's "loyalty" to the brand in a context of individual transaction) is a method of measuring consumer satisfaction with the particular transaction and is not an indicator of brand loyalty.

According to the research conducted on the Polish market (KPMG, 2017) the foundation of good customer experience in Poland is Reliability – its independent influence on the willingness to recommend the brand by Poles stands at as much as 22%. Keeping your word and building trust are features that should characterize every company operating on the market, but the results of our research emphasize that building trust in the brand pays off. Building a credible and consistent image is a special challenge in the era of digitization.

The second priority in building good experience for Polish customers is Time and Effort. The independent influence of this factor on the willingness to recommend stands at 17%. It is particularly important for companies offering products and services that require many interactions with the seller both at the stage of purchase and use.

The third priority for the good experiences of Polish customers is Problem Solving, which accounts for 17% of our willingness to recommend the brand. The high position of this factor is in part a consequence of the high importance of Reliability and Time and Effort. If problems arise during the purchase or use of a product or service, solving them properly is essential for the brand to maintain its credible image.

6. Conclusion

Focus on managing customer experience as seen through the customer's eyes is one of the key elements of digital business transformation. We must remember that digital transformation means not only directing the company to the effective use of innovative solutions based on digital technologies, but above all reorienting the business in such a way as to make it operate effectively in an

increasingly competitive market, proactively adjusting its activities to the changing needs of consumers who they are also becoming more and more "digital".

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Social Attitudes Towards the Benefits of and Barriers to the Development of Electromobility[1]

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Kamil Dudek, Damian Dziedzic

1. Introduction

The development of electric cars and the interest in them among consumers have increased significantly in recent years. Buyers' awareness of their advantages and benefits is also changing. Ecological trends also contribute to the growth of their popularity. However, there are still many barriers to the wider expansion of electric cars worldwide. The aim of the article is to analyze and evaluate society's knowledge of the ecological benefits of using an electric car and to identify the most important barriers to the development of electromobility in Poland. The research used in the study was conducted on a group of both electric car owners and people who use internal combustion cars and are considering purchasing an electric car in the future.

Electric vehicles (BEVs) are becoming a more and more common means of transport and their popularity is growing by the year (Kurzempa, 2018). Currently, the world's leading car manufacturers offer at least one electric vehicle or are in the process of introducing it to the market. Nowadays, electric cars are not a real competition to combustion cars, but their dynamic development can be expected in the near future (Chłopek & Lasocki, 2014).

The dynamic development of this phenomenon brings with it a lot of controversy and social discussions on the significance and future of electromobility. The perception and social attitude towards electromobility is therefore a current and interesting research issue.

The aim of the study is to find out about the public opinion on electric cars, their advantages and disadvantages and barriers to the implementation of electromobility on a broader scale, both among owners of electric cars and people potentially interested in purchasing them.

2. Literature Review

The subject of electromobility is more and more often discussed in scientific research. Scientists conduct research in the field of technical, economic, ecological and social aspects of this phenomenon. For the purposes of this article, the literature on the subject of social attitudes towards electric vehicles was analyzed. Some of the studies verified the respondents' knowledge about the benefits of electromobility and the way electric cars operate, others aimed at identifying barriers to their wider expansion, while others touched upon the environmental aspects of electromobility.

An example of research focusing on the attitude towards EV is the research conducted in 2018 on a group of students from Rzeszów University of Technology (n = 100) on their knowledge of and attitude towards electric cars. Its results indicate that electric cars are little known, but at the same time they arouse great interest and their image in the minds of young people is very positive. Their limitations are also noticeable, the most importantly too high purchase price, but also other factors, such as: lack of sufficient information about them and unsatisfactory technical parameters, mainly the long time needed to charge the battery and too short distance that can be traveled on a single charge of the battery (Klamut, 2018). Similar conclusions were published in articles by W. Gis, M. Menes and J. Waśkiewicz (2016; 2014).

Despite the growing offer of electric vehicles, the development of this market faces many barriers. One of them is the insufficiently developed charging infrastructure, high purchase costs, lack of public trust in the new technology, or insufficient knowledge about the benefits of electromobility (Biresselioglua, Kaplanb & Yilmaza, 2018; Krawiec & Krawiec, 2017; Lewicki, 2018).

The most common barriers to the development of this phenomenon appearing in the literature are the high prices of electric vehicles, the lack of charging stations and the driving range per one charging cycle (Drábik & Krnáčová, 2018; Sendek-Matysiak, 2020; Lewicki, 2018).

The development of the electric vehicle sector is also limited by the mentality of the society, mainly the fear of change and often misunderstanding of the effects of innovation. Popularization of electric vehicles requires changing the way of life and the perception of a car. The change resulting from the electrifica-

tion of transport may be beneficial for some people, but unacceptable for some, e.g. long vehicle charging will require more flexibility and patience from the user (Janczewski, 2017).

In terms of barriers and ecological aspects of electromobility, a survey was carried out among the inhabitants of the Podkarpackie Province (n = 552). The aim of the study was to determine the perception of barriers to the development of electromobility in the context of the ecological attitudes of the inhabitants of the Podkarpackie Province. The conducted research shows that the perception of electromobility is related to the so-called environmental attitude of the surveyed inhabitants of the Podkarpackie Province. In their responses, the respondents indicated three main groups of barriers, such as: high price of vehicles, small number of charging places and short distance that can be traveled on a single charge. The second group included the lack of information and financial incentives, and the third the lack of a secondary market and technical difficulties. The surveyed residents of the Podkarpackie Province also emphasized the small amount of information on the benefits of electromobility (Kud, 2019). In addition to scientific articles, the literature on the subject also includes many industry studies and reports related to electromobility. One of them is InsightOut Lab – Report from 2020, which shows that every second Pole would like to have an electric car. According to a survey conducted by InsightOut Lab in cooperation with Volkswagen, most respondents did not know that an electric car can be charged from a standard socket. The vast majority of respondents also did not know what to do to install a home electric car charging station (OutLab, 2020).

Similar results were published in a 2017 study on electromobility in Poland conducted by the Kantar Public Social Research Center at the request of Innogy Polska. The survey shows, inter alia, that more than half of Poles declare that they would be willing to buy an electric vehicle. Women who favor electric cars consider fuel consumption, operating costs and the purchase price to be the most important criteria when buying a vehicle. Among men, the most important criteria turned out to be the cost of using the car, price and fuel consumption (Public, 2017).

Based on the quoted literature, it can be concluded that the topic of electromobility, although not new, is still little known among the society. While the benefits of having an electric vehicle are known to most of the respondents, barriers to their development are often dictated by stereotypes and outdated information. The social barrier is an important factor in the development of the electromobility phenomenon and the appropriate transfer of reliable information on electromobility may become a key factor in reducing the social barrier and winning people to electric vehicles.

3. Methodology of the Study

3.1. The Purpose of the Study

Due to the difficult access to the population related to the large dispersion of objects and the protection of personal data of vehicle owners, the authors decided to conduct a pilot study. The analysis covers the perception of benefits, mainly related to environmental aspects and barriers to the development of electromobility in the opinion of BEV owners and not owners.

We tried to find factors shaping the opinions of respondents on the topics discussed, as well as the similarities and differences between these groups, taking into account factors such as: respondents' age, gender, earnings, the fact of owning a BEV and their impact on the perception of barriers and benefits of BEV ownership.

Based on these assumptions, the following hypotheses were formulated:

H1 – Perceiving environmental care as a key benefit of using BEV is related to possessing a BEV,

H2 – Perceiving environmental care as a key benefit of using a BEV is related to age,

H3 – Perceiving a BEV as expensive is related to net earnings,

H4 – Perceiving environmental care as a key benefit of using a BEV is related to gender,

H5 – Perceiving a BEV as expensive (compared to internal combustion cars) is related to net earnings,

H6 – Perceiving infrastructure development as a key limitation of EV transport is related to owning a BEV.

3.2. Data Collection and Sampling

The authors used the survey questionnaire CAPI for the purposive sampling. Data was collected at the turn of 2020 and 2021 from social media and web forums for electromobility enthusiasts. The survey consisted of 17 questions, including 12 single-choice questions, 3 multiple-choice questions and 2 open-ended questions. 60 BEV owners and 185 people who do not have BEV participated in the survey. Assuming that at the end of 2020 there were about 6,000 electric cars in Poland and their owners constitute the studied population, the sample size is 60, the significance level equals 5% and the maximum error is 13%. Therefore, a key limitation of the study is that it cannot reasonably be inferred from the BEV owners population.

3.3. Data Analysis

To study the relationship between the variables, the authors decided to use the Chi-square statistic due to the nominal scale in which the majority of answers in the survey were provided. The following tests were calculated using the Statistica program:

- ■ Chi-square independence test,
- ■ maximum likelihood Chi-square.

To test the strength of the relationship between the variables, the phi coefficient was calculated for the 2×2 tables and Cramér's V for the tables larger than 2×2. In the case of questions where the answers were on the nominal ordinal scale or could be reduced to this scale, the Spearman's rank correlation coefficient was also calculated. The results of statistical analysis were supplemented with a summary of answers to selected questions, which were presented in the form of MS Excel charts. The characteristics of the sample are presented below in tabular form.

Table 7.1. Distribution of the sample

Sample size N = 245		Frequency	Percent (%)
Gender	male	147	60.00
	female	98	40.00
Education	primary education	12	4.90
	secondary education	85	34.70
	higher education	148	60.40
Monthly income	< 2 500 PLN	63	25.70
	2 501–3 500 PLN	36	14.70
	3 501–5 000 PLN	58	23.70
	5 001–10 000 PLN	54	22.00
	>10 000 PLN	34	13.90
Place of residence	village	45	18.40
	city up to 20 000 residents	24	9.80
	a city from 20 000 up to 100 000 residents	34	13.90
	a city from 100 000 up to 500 000 residents	42	17.10
	a city of over 500 000 residents	100	40.80

Source: own study.

3.4. Findings

The authors firstly wanted to investigate the factors influencing the perception of environmental care as a key benefit of BEV use. The first potential factor taken into account as determinant was BEV ownership (Table 7.2). Out of 60 BEV

owners, 34 (57%) indicated that concern for the environment is a key benefit of using a BEV, while out of 185 people who do not have a BEV, as many as 152 (82%) indicated concern for the environment as a key benefit of using a BEV.

Table 7.2. Possessing BEV x Concern for the environment

Characteristics	Cardinality table – bolded cells have count > 10			
	Concern for the environment as a key benefit of BEV	Do you have an electric car?		Row
		No	Yes	Totals
Count	No	**33**	**26**	59
Column percent		**18%**	**43%**	–
Row percent		**56%**	**44%**	–
Total percent		**13%**	**11%**	24%
Count	Yes	**152**	**34**	186
Column percent		**82%**	**57%**	–
Row percent		**82%**	**18%**	–
Total percent		**62%**	**14%**	76%
Count	Overall	185	60	245
Total percent		76%	24%	–

Source: own study.

The hypothesis of Chi-square test of independence is stated below:

H0: Perceiving environmental care as a key benefit of using BEV is not related to possessing a BEV,

H1: Perceiving environmental care as a key benefit of using BEV is related to possessing a BEV.

Table 7.3. Chi-square and Phi coefficient statistics

Statistics	Statistic: Do you have an electric car? x Concern for the environment		
	Chi-square	df	p
Pearson Chi-square	16.108	df=1	p=.00006
M-L Chi-square	14.879	df=1	p=.00011
Phi coefficient.	−0.256	–	–

Source: own study.

The critical value of the chi-square statistics at 1 degree of freedom and alpha level of 0.05 belongs to the compartment <3.841; +∞). The value of the chi-square test of independence is 16.108, therefore it belongs to the critical compartment. M-L Chi-square also belongs to the critical compartment (Table 7.3). Thus, there

are grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of environmental care as a key benefit of using BEV depends on whether or not you own such a car. This relationship is true at alpha = 0.00006. Interestingly, this relationship is opposite to what might be expected, because this benefit was more important for respondents who do not have BEV. The value of the Phi-coefficient statistic is −0.26, so the relationship is not strong.

Another factor that could potentially influence the perception of environmental protection as a key benefit of using BEVs was age (Table 7.4). Due to the slight deviation of the age of the respondents from the average, the youngest and the oldest respondents are sparsely represented.

Table 7.4. Age x Concern for the environment as a key benefit of BEVs

| Characteristics | Cardinality table – bolded cells have count > 10 | | |
| | Age | Concern for the environment as a key benefit of BEV | | Row |
		No	Yes	Totals
Count	0–18	0	8	8
Column percent		0%	4%	–
Row percent		0%	100%	–
Total percent		0%	3%	3%
Count	19–25	**17**	**85**	102
Column percent		**29%**	**46%**	–
Row percent		**17%**	**83%**	–
Total percent		**7%**	**35%**	42%
Count	26–45	**34**	**78**	112
Column percent		**58%**	**42%**	–
Row percent		**30%**	**70%**	–
Total percent		**14%**	**32%**	46%
Count	46–65	5	**15**	20
Column percent		8%	**8%**	–
Row percent		25%	**75%**	–
Total percent		2%	**6%**	8%
Count	>65	3	0	3
Column percent		5%	0%	–
Row percent		100%	0%	–
Total percent		1%	0%	1%
Count	Overall	59	186	245
Total percent		24%	76%	100%

Source: own study.

Hypothesis of Chi-square test of independence is stated below:

H0: Perceiving environmental care as a key benefit of using a BEV is not related to age,

H1: Perceiving environmental care as a key benefit of using a BEV is related to age.

Table 7.5. Chi-square and Phi coefficient statistics

Statistics	Statistic: Age x Concern for the environment as a key benefit of BEV		
	Chi-square	df	p
Pearson Chi-square	17.48458	df=4	p=.00156
M-L Chi-square	18.5768	df=4	p=.00095
V Craméra	0.2671435	–	–

Source: own study.

The critical value of the chi-square statistics at 4 degrees of freedom and alpha level of 0.05 belongs to the compartment <9.488; +∞). The value of the chi-square test of independence is 17.485, therefore it belongs to the critical compartment. M-L Chi-square also belongs to the critical compartment (Table 7.5). Thus, there are grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of environmental care as a key benefit of using BEV depends on age. This relationship is true at alpha = 0.0015. For minors and young adults, environmental protection was indicated as the key benefit from BEV use more often than in other groups. The value of the Cramér's V statistic is 0.27, so the relationship is not strong.

The third factor taken into account, potentially shaping the perception of environmental protection as a key benefit of BEV, was net earnings (Table 7.6).

Table 7.6. Net earnings per month x Perceiving BEV as expensive

Characteristics	Net earnings per month in PLN	Cardinality table – bolded cells have count > 10		Row
		Electric cars are expensive and few can afford to buy them		Row
		Yes	No	Totals
Count	<2500	**57**	6	63
Column percent		**31%**	10%	–
Row percent		**90%**	10%	–
Total percent		**23%**	2%	26%

Table 7.6. cnt'd

Characteristics	Net earnings per month in PLN	Cardinality table – bolded cells have count > 10		Row
		Electric cars are expensive and few can afford to buy them		Row Totals
		Yes	No	Totals
Count	2501–5000	**68**	**26**	94
Column percent		**37%**	**44%**	–
Row percent		**72%**	**28%**	–
Total percent		**28%**	**11%**	38%
Count	5001–10000	**43**	**11**	54
Column percent		**25%**	**15%**	–
Row percent		**80%**	**20%**	–
Total percent		**18%**	**4%**	22%
Count	>10000	**18**	**16**	34
Column percent		**10%**	**27%**	–
Row percent		**53%**	**47%**	–
Total percent		**7%**	**7%**	14%
Count	Overall	171	74	245
Total percent		70%	30%	100%

Source: own study.

Hypothesis of Chi-square test of independence is stated below:

H0: Perceiving BEVs as expensive is not related to net earnings,

H1: Perceiving BEVs as expensive is related to net earnings.

Table 7.7. Chi-square and Phi coefficient statistics

Statistics	Statistic: Net earnings per month in PLN x Electric cars are expensive and few can afford to buy them		
	Chi-square	df	p
Pearson Chi-square	13.76678	df=2	p=.00102
M-L Chi-square	16.16889	df=2	p=.00031
V Craméra	0.2789836	–	–

Source: own study.

The critical value of the chi-square statistics at 2 degrees of freedom and alpha level of 0.05 belongs to the compartment <5.991; +∞). The value of the chi-square test of independence is 13.767, therefore it belongs to the critical compartment. M-L Chi-square also belongs to the critical compartment (Table 7.7). Thus, there are grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of BEVs as expensive depends on net earnings.

This relationship is true at alpha = 0.001. The lowest earners most often indicated concern for the environment as the key benefit of using BEV while the highest earners indicated this factor the least frequently. The value of the Cramér's V statistic is 0.28, so the relationship is not strong.

The last factor taken into account, potentially shaping the perception of environmental protection as a key benefit from using BEVs was gender (Table 7.8). The respondents' answers show that women 20% more often indicated environmental protection as a key benefit of BEVs.

Table 7.8. Gender x Concern for the environment as a key benefit of BEV

Characteristics		Cardinality table – bolded cells have count > 10		
	Gender	Concern for the environment as a key benefit of BEV		Row
		No	Yes	Totals
Count	Male	**47**	**100**	147
Column percent		**80%**	**54%**	–
Row percent		**32%**	**68%**	–
Total percent		**19%**	**41%**	60%
Count	Female	**12**	**86**	98
Column percent		**20%**	**46%**	–
Row percent		**12%**	**88%**	–
Total percent		**5%**	**35%**	40%
Count	Overall	59	186	245
Total percent		24%	76%	100%

Source: own study.

Hypothesis of Chi-square test of independence is stated below:

H0: Perceiving environmental care as a key benefit of using a BEV is not related to gender,

H1: Perceiving environmental care as a key benefit of using a BEV is related to gender.

Table 7.9. Chi-square and Phi coefficient statistics

Statistics	Statistic: Do you have an electric car? x Is an electric car in any way worse than an internal combustion car?		
	Chi-square	df	p
Pearson Chi-square	12.51716	df=1	p=.00040
M-L Chi-square	13.38194	df=1	p=.00025
Phi coefficient	-.226032	–	–

Source: own study.

The critical value of the chi-square statistics at 1 degree of freedom and alpha level of 0.05 belongs to the compartment <3.841; +∞). The value of the chi-square test of independence is 15.643, therefore it belongs to the critical compartment. M-L Chi-square also belongs to the critical compartment (Table 7.9). Thus, there are grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of environmental care as a key benefit of using BEV depends on gender. This relationship is true at alpha = 0.0004. The value of the Phi-coefficient statistic is −0.23, so the relationship is not strong.

Another issue was whether the perception of BEVs as expensive (in relation to combustion vehicles) depends on income (Table 7.10).

Table 7.10. Net earnings per month x Concern for the environment as a key benefit of BEV

Characteristics	Net earnings per month in PLN	Cardinality table – bolded cells have count > 10		Row
		Electric cars are expensive and few can afford to buy them		
		No	Yes	Totals
Count	<2500	15	48	63
Column percent		20%	28%	–
Row percent		24%	76%	–
Total percent		6%	20%	26%
Count	2501–5000	37	57	94
Column percent		50%	33%	–
Row percent		39%	61%	–
Total percent		15%	23%	38%
Count	5001–10000	11	43	54
Column percent		15%	23%	–
Row percent		20%	80%	–
Total percent		4%	18%	22%
Count	>10000	16	18	34
Column percent		27%	10%	–
Row percent		47%	53%	–
Total percent		7%	7%	14%
Count	Overall	59	186	245
Total percent		24%	76%	100%

Source: own study.

Hypothesis of Chi-square test of independence is stated below:
H0: Perceiving BEVs as expensive (compared to internal combustion cars) is not related to net earnings.

H1: Perceiving BEVs as expensive (compared to internal combustion cars) is related to net earnings.

Table 7.11. Chi-square and Phi coefficient statistics

Statistics	Statistic: Net earnings per month in PLN x Concern for the environment as a key benefit of BEV		
	Chi-square	df	p
Pearson Chi-square	15.64307	df=4	p=.00354
M-L Chi-square	15.0644	df=4	p=.00457
V Craméra	0.2526841	–	–

Source: own study.

The critical value of the chi-square statistics at 4 degrees of freedom and alpha level of 0.05 belongs to the compartment <9.488; +∞). The value of the chi-square test of independence is 15.643, therefore it belongs to the critical compartment. M-L Chi-square also belongs to the critical compartment (Table 7.11). Thus, there are grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of BEV as expensive (compared to internal combustion cars) depends on income. This relationship is true at alpha = 0.004. This relationship seems to be a bit surprising, as it would be expected that along with the increase in income, the frequency of indicating the BEV price as a development barrier would decrease. People earning 5 001–10 000 PLN per month most often indicated the price as a barrier to the development of electromobility The value of the Cramér's V statistic is 0.25, so the relationship is not strong.

Another barrier that was analysed was the electromobility infrastructure. The authors decided to investigate the impact of possessing a BEV on the perception of this infrastructure. The respondents were divided into 3 groups: BEV owners; people who do not have a BEV but are considering having one, and people who do not have a BEV and are not currently considering having one.

Table 7.12. Possessing BEV x Poorly developed EV infrastructure

Characteristics	BEV owning	Cardinality table – bolded cells have count > 10		
		Poorly developed EV infrastructure		Row
		No	Yes	Totals
Count	Yes	**75**	**25**	100
Column percent		**42%**	**38%**	–
Row percent		**75%**	**25%**	–
Total percent		**31%**	**10%**	41%

Table 7.12. cnt'd

Characteristics	BEV owning	Cardinality table – bolded cells have count > 10		
		Poorly developed EV infrastructure		Row
		No	Yes	Totals
Count	No	**59**	**26**	85
Column percent		**33%**	**40%**	–
Row percent		**69%**	**31%**	–
Total percent		**24%**	**11%**	35%
Count	Considered	**46**	**14**	60
Column percent		**26%**	**22%**	–
Row percent		**77%**	**23%**	–
Total percent		**19%**	**6%**	24%
Count	Overall	180	65	245
Total percent		73%	27%	100%

Source: own study.

Hypothesis of Chi-square test of independence is stated below:

H0: Perceiving infrastructure development as a key limitation of EV transport is not related to BEV ownership,

H1: Perceiving infrastructure development as a key limitation of EV transport is related to BEV ownership.

Table 7.13. Chi-square and Phi coefficient statistics

Statistics	Statistic: BEV owning x Poorly developed EV infrastructure		
	Chi-square	df	p
Pearson Chi-square	1.152839	df=2	p=.56191
M-L Chi-square	1.141674	df=2	p=.56505
V Craméra	0.0685964	–	–

Source: own study.

The critical value of the chi-square statistics at 2 degrees of freedom and alpha level of 0.05 belongs to the compartment <5.991; +∞). The value of the chi-square test of independence is 1.153, therefore it does not belong to the critical compartment (Table 7.13). M-L Chi-square does not belong to critical compartment either. Thus, there are no grounds for rejecting the null hypothesis and adopting an alternative hypothesis. The perception of infrastructure development as a key limitation of EV transport is not related to BEV ownership. The value of the Cramér's V statistic is 0.07, so there is no relationship.

4. Conclusion

The results of the study confirm and supplement the knowledge about social attitudes in the field of benefits of and barriers to the development of electromobility in Poland. The exact results of the study are presented in Table 7.14.

Table 7.14. Summary of the study results

No.	Hypothesis	Adopted
H1	Perceiving environmental care as a key benefit of using a BEV is related to possessing a BEV	Yes
H2	Perceiving environmental care as a key benefit of using a BEV is related to age	Yes
H3	Perceiving a BEV as expensive is related to net earnings	Yes
H4	Perceiving environmental care as a key benefit of using a BEV is related to gender	Yes
H5	Perceiving a BEV as expensive (compared to internal combustion cars) is related to net earnings	Yes
H6	Perceiving infrastructure development as a key limitation of EV transport is related to BEV possessing	No

Source: own study.

The study showed that the public is aware of the availability and benefits of electric cars, while awareness is limited on many issues. The results of the survey showed that it was women who were primarily guided by their concern for the environment when buying an electric car. Environmental aspects turned out to be more important for people who do not own electric cars and for younger, better educated respondents.

The respondents indicated poorly developed infrastructure and economic aspects as the main barriers to the development of electric cars. While the respondents unanimously assessed problems with infrastructure as significant, regardless of their socio-economic characteristics, the economic barrier depended largely on their income.

An interesting aspect was the relatively large share of electric car owners in the study, which broadened their perspective and provided comparative opportunities.

The key limitations of the study were sampling related to the size, structure of features and randomness. The conducted research may be an introduction to a broader analysis of the correlation of factors influencing the perception of barriers to and opportunities for the development of electromobility in Poland. Repeating the study on a larger sample would give greater research opportunities, and the continuous development of electromobility increases the chances of reaching a larger group of respondents owning a BEV.

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The Concept of Digital Twins in Logistics[1]

Marta Uznańska

1. Introduction

Continual advancements in digitalization, information technology and operational technology have changed everything and created new opportunities not only for Logistics Industry. Nowadays business process modelling is gaining notable importance, because it helps to solve a wide range of tasks. Bušinska and Kirikova (2016) have grouped business process modelling goals in to: business process graphical reflection, visual analysis of different business process aspects, business process analysis with quantitative methods, design of the business process for further automation and creation of the business process model for further implementation. Emerging real-time applications in information technology, and operational technology enable new innovative concepts to design and operate cyber-physical systems. A promising approach, which is stated to be a primary simulation-based approach in the context of Industry 4.0, as well as a key technology for several industries is the Digital Twins concept. A Digital Twins connects the virtual representation of a physical object, system or process by available information and sensor data streams, which allows to gather new information about the system by applying analytic functions. This technology can change the way companies design, monitor and manage their physical assets. What is more, it is considered as one of the most prominent trends in Logistics. The Digital Twins concept can be applied in packaging processes, shipments, designing and redesigning warehouse systems and their infrastructure, as well as in a variety of applications along the entire supply chain to assets performance monitoring and increase effectiveness. The aim of this paper is to present the Digital Twins concept and examples of its implementation in logistics compa-

nies, as well as evaluating its challenges. The paper assesses the potential usage of the Digital Twins concept in logistics. Author will tries to answer the question if the Digital Twins concept is just another short-lasting trend or a long-lasting solution that can be used in Logistics.

2. Defining the Digital Twin

Digital Twin can be considered as a living entity, being the digital model of its physical counterpart that grows intellectually, which means that it needs to experience everything that happened in the real world (Mobinius, 2020). For centuries, people have developed sophisticated models of real entities, that had various business purposes. In the past, the model was a faithful representation of real word objects, while modelling was understood as a process of mapping, just to obtain information about the system (Krcmar & Schwarzer, 1994). Moreover, it can be stated that until the recent past, having extensive knowledge of physical object was associated with the need to be very close to it, because the information about it was inseparable from the physical object (Grieves & Vickers, 2017). Other words, for ages we were able to use only basic information (such as measurements) and observations concerning physical object and its model. The creation of engineering drawings scarcely has changed until 1957, when Patrick Hanratty developed the first numerical control programming tool (PRONTO), and when work on automating engineering design was launched (Tornincasa & Monaco, 2010). In MIT Phd Thesis of Ivan Sutherland (1963) *Sketchpad, A Man-Machine Graphical Communication System* we can find the origins of graphic user interface, with a light pen to manipulate the object displayed on a cathode ray tube. The Computer Aided Design (CAD) has constantly evolved since then, from simple 2D designs into complex, multi-layered 3D structures with kinematic movement and detailed meta-data (Beck, 2017). By the 1980s, commercial CAD systems were used in the aerospace and automotive industries. Today, one can notice pivotal improvements of CAD programs in the level of analysis, management of products, including modelling, engineering, manufacturing and maintenance (CadCulture, 2015). Moreover, almost all commercial packages are easy-to-use tools to design, render, animate and manage data to create digital models with the possibility of visualizing and simulating products, which may result in reduction in cost compered to physical prototypes (Tornincasa & Monaco, 2010). With the Internet of Things (IoT), connectivity becomes an integral part of simulation models, changing the way digital and physical objects interact. A wide range of sensors and network technologies link previously offline physical assets to digital models, giving endless testing and simulation possibilities. CAD models are just

a static representation of form, simulation is more dynamic, enabling one to add behaviour and influence of external stimuli, impact by forces, without a fear of destroying the physical object. The basic concept of the Digital Twins is to be able to design, test, manufacture and use virtual versions of holistic systems, resulting in failures reduction of the working physical system, expenses reduction and minor time consumption (Grieves & Vickers, 2017).

It can be assumed that NASA pioneered the first use of a digital twin in 1970s during a mission to the moon when it had decided to test potential recovery strategies for the damaged Apollo 13 spacecraft. This approach allowed mission controllers to *rapidly adapt and modify the simulations to match conditions on the real-life spacecraft, so they could research, reject, and perfect the strategies required to bring astronauts home* (Ferguson, 2020). Creating a mirroring system assured NASA that a procedure chosen to repair machinery from Earth before sending instructions and systems out to space is safe. This can be considered as the beginning of the digital twin concept as we know it nowadays. However, Digital Twins first became a public notion in 2002 when they were introduced by Michael Grieves as a *Conceptual Ideal for PLM* in a presentation regarding his product lifecycle management (PLM) research at the University of Michigan. It had *all the elements of the Digital Twin: real space, virtual space, the link from real space to virtual space, the link for information flow from virtual space to real space and virtual sub-spaces* (Grieves & Vickers, 2017, p. 93). What needed to be added here is that, the information being collected about the physical object at this time was limited, collected manually and very often paper based (Grieves, 2014). The observed development of the Internet of Things (IoT), Internet of Behaviour (IoB), Big Data, Artificial Intelligence, PLM, CAD, Virtual Reality (VR), Augmented Reality and cloud computing allows the physical and digital world to be managed as one. Many of the key enabling technologies have reached the level of maturity necessary to support the use of Digital Twins in the enterprises. These are technologies that allows for cheap data storage and computing power, which, thanks to the availability of robust, high-speed wired and wireless networks and inexpensive and reliable sensors, have enabled advancements in data analytics resulting in an increase in the adoption of the Digital Twin concept.

Grieves, who has first applied the DT concept, and Vickers (2017) assume that it is *a set of virtual information constructs that fully describes a potential or actual physical manufactured product from micro atomic level to the macro geometrical level,* what is more *at its optimum, any information that could be obtained from inspecting a physical manufactured products can be obtained from its DT.* It can be assumed that the most habitually used definition of Digital Twin is one presented by Glassegen and Stargel (2012) stating that Digital Twin is inte-

grated multiphysics, multiscale probabilistic ultra-realistic simulation of systems or products which can mirror the life of its corresponding twin using available physical objects, history and real time data. Besides that, this original definition is a construct to define DT vehicles used by NASA, it points out three major parts: physical products, virtual products and the connections between them. What is confirmed by another definition proposed by Trauer et al. (2020), who define Digital Twin as *a virtual dynamic representation of a physical system, which is connected to it over the entire life cycle for bidirectional data exchange*. The connection between physical and virtual objects is also highlighted in a definition proposed by Rosen et al. (2015), who defines DT as a model which can interact between autonomous system behaviours and the environment in the physical world, however it is not only a collection of all digital artefacts, it has a structure, and what is more all elements are connected creating metainformation as well as semantic. Two-way interaction between the digital and physical worlds can engender innumerable benefits. First of all, the physical object can be made more intelligent to actively adjust its real-time behaviour due to recommendations made by the virtual object and as a consequence the virtual object can be more factual to reflect accurately the real world state of the physical object (Tao, et al., 2018). Definition of Digital Twin by Söderberg et al. (2017) confirms it, stating it is about *using a digital copy of the physical system to perform real-time optimalization*. Transition of data is also highlighted by El Saddik (2018) who considers, which seems to be very interesting, DT as *digital replication of living as well as non-living entities that enable data to be seamlessly transmitted between the physical and virtual worlds.*

It seems to be very interesting to investigate the approach in defining Digital Twins not only by the academics, but by the representatives of business. FutureBridge[2] considers Digital Twin as an executable virtual model of physical equipment, which can be continuously updated across the entire lifecycle of the equipment (FutureBridge, 2020). What is more, according to Cisco (Deign, 2018) DT is able to help marketers by showing what happens to products as they get older. As stated in SAP (2020), a Digital Twin is a virtual representation of a physical object or system (high-tech lookalike) that uses data, machine learning, IoT to help companies optimize, innovate and deliver new services. MH&L (Material Handling & Logistics, 2019) highlights the values of DT that include: rapid collaboration; holistic visibility; accuracy, efficiency in responding to demand; mon-

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[2]   FutureBridge tracks and advice enterprises on the future of industries from a 1 – to – 25 – year perspective. with its data and analytics platform, deep techno-commercial knowledge, and networks of start-ups, technology partners specialise in research and advisory.

etization of IoT data; predictiveness; proactive service and closer collaboration with customers. In practise, due to the large number of different applications and stakeholders involved, it is hard to get consensus on what constitutes a Digital Twin. DHL has marked out attributes of a DT as follows: a virtual model of a real "thing", that simulates both the physical state and behaviour of the thing, being a unique, associated with a single, specific instance of the thing that is connected to and is able to upload itself in response to known changes to the thing's state, condition or context, providing value through visualization, analysis, prediction or optimization (DHL Trend Research, 2020). Stoecker (2020), Vice President of Global Services at General Electrics (GE Digital) defines DT as focusing around enabling the lifecycle of decision making for field services, focusing on integrating their operational technology and informational technology. Senior Vice President at GE Digital (till April 2020, currently working for Cisco) Lohmeyer (2019) considers DT to be a software representation of a physical thing or system, highlighting its benefits for industries such as: usefulness for correlating variables or running machine learning algorithms for better understanding the past; ease of detecting anomalies and improving model accuracy in order ty see present conditions, and what is also very important to predict the future. In addition to the use of advanced analytics and machine learning, to reduce operating costs and risk, GE Digital also mentions other benefits of DT: increased reliability and availability, reduced risk in sense of protecting health and safety of employees, the environment, business objectives, by asset reduction and process related incidents and avoiding unplanned downtime, reduction in maintenance cost, improvements in production, ensuring product quality (GE Digital, 2020). Siemens approach to defining DT is analogous to those presented, interpreted as a virtual double of a product, a machine, a process or of complete production facilities that enables a product "to be more conceived, simulated and manufactured faster than in the past, but also designed in a way to improved economy, performance, robustness or environmental compatibility" (Siemens, 2020).

The evolution of traditional business towards Industry 4.0 forces business process, manufacturing systems and others to become more adaptive and flexible through integrated automated decision making and system behaviour-based prediction (Kraft, 2016). Digital Twin may be the key to success in those turbulent and challenging times in many fields. In manufacturing, application of a DT concept shows results in increase efficiency, reliability and flexibility, reconfigurations and maintenance processes improvement. Possibility of figuring out failures in advance is of pivotal significance. It also enables predicting and designing next generation products, upgrading them and what is more supporting upkeep of manufacturing assets, giving information about the need of service and main-

tenance. Digital Twin concept is also considered as a great tool for bolstering critical decision-making in management (Adrodegari et al, 2017). Needless to say, Digital Twins continues to be essential technologies, generating value and supporting the business to gain competitive advantages.

3. Implementation of Digital Twin in Logistics

The logistics sector connects companies to markets, providing diverse services, such as: freight forwarding, multimodal transportation, warehousing and inventory management and many others on a global scale, turning it into one of the key elements of trade. Inefficient logistics raise the cost of doing business (World Bank, 2018), while efficient logistics services facilitate the mobility of products, ensuring their safety, speed and cost reduction. What one can notice is that the Digital Twin concept, compared to its use e.g. in manufacturing, has not yet reached such a widespread application in the logistics sector. However what is of pivotal significance, many of key enabling technologies are already in common use in numerous logistics processes. Digital Twins can be used to collect specific data in transportation, shipment and parcel deliveries, primarily concerning product and packaging, allowing identification of potential weaknesses and recurring trends and possible improvements. Worth mentioning is DT implementation to reduce losses in refrigerated supply chains, especially in times when cold chains seem to have pivotal significance because of COVID-19 vaccination logistics. Defraeye et. al (2019, p. 779) developed a digital fruit twin, that simulates the fruit's thermal behaviour throughout the transcontinental cold chain based on the measured environmental temperature conditions and impact of *the evolution of associated quality attributes, due to enzymatically-driven, temperature-dependent biochemical degradation reactions.* Results have shown that DT can be a tool to predict the position of quality loss with internal features of such a complex products, and have confirmed the possibility of improvement of refrigeration processes and logistics to reduce loses, minimizing the environmental impact.

Growth in e-commerce resulted in increased demand for packaging and containers as well in a commissioning times reduction. Application of robotic software for vision-guided random flow picking and packing – PickMaster®Twin, introduced by ABB, gives 15% faster picking times for increased productivity, increasing output and total line efficiency by 40 % (ABB,2019). The overwhelming majority of items move through logistic networks in some form of packaging, that is why designing, monitoring, packages and containers management are considered the greatest summons to contest for the industry (DHL Trend

Research, 2020). To address these challenges, Math2Market has developed a digital twin software program GeoDict®. Accurate numerical material simulations performed provide useful insights into the material's microstructure that could not have been delivered via traditional experiments. It contributes a unique understanding of the physical properties of materials, and allows modelling material behaviour underweight capacities, the temperature, vibration and shocks load experienced in transit, consequently accelerating and cutting down cost in the material development and using process (Math2Market, 2021). Combining product and packaging data enables improvements efficiency by optimising the packaging selection automation and minimalization of empty shipment space.

The concept of Digital Twin is also an acknowledged opportunity for maritime sector improvement in fleet optimisation, port and end-to-end supply chain optimisation. Project *Container 42*, developed by The Port of Rotterdam in collaboration with a range of stakeholders, including IBM, Cisco, Esri, Axians, Intel, HyET Solar, Van Donge & de Roo, Awake.ai, Betta Batteries, Simwave, Advanced Mobility Services, Kalmar and Shipping Technology and many others, (Manaadiar, 2019) is a great example. The main aim of this project is to collect and process data on the impact of the environment to which these containers are exposed during transport by various means of transport. During a two years' journey, Container 42, equipped with sensors and communications equipment, is supposed to collect and measure changes in parameters including vibrations, pitch, position, noise, air pollution, humidity providing insight into the challenges faced during transport and logistics. Users should access real-time data considering local infrastructure, water and air quality at different stages of this journey with Intel® Connected Logistics Platform. What is more, Container 42 has also been fitted with solar panels, allowing determining how much power it can generate during ship, train or truck journey. Most of the applied technology is already being used at the Port of Rotterdam, as a foundation of the future digital port where autonomous ships can berth. There would be numerous outcomes resulting from using collected data. The efficiencies that Container 42 could have exemplified include shippers' avoidance of losses and missed deliveries, certainty in scheduling, reduction in fuel use, and other potentially large environmental dividends (Duggan, 2019). There is no further notification on the journey of these containers, the web site is providing data from 29th of May 2019, with no update. Except for that fact, project Container 42 only highlights the potential of the concept of digital twin in transportation and sector of logistics

Error elimination, increased efficiency, significant reduction in operating costs, increased precision and speed of information flow are some of the benefits of automation in the warehouse (Buła et al, 2020). However, designing and im-

plementation of automation in a warehouse is time-consuming and expensive. Warehouse DT, such as CognitiveFlow, supports the design and layout, allowing to create simulation adjusted to operational real-life-data that enables analysis of the potential impact of a layout change, before the actual change is made. Artificial Intelligence based digital twin solution, developed by the start-up Cognition Factory is used for the planning, configuration, and continuous optimization of mobile robots and material handling systems in the warehouse (Cognition Factory, 2020). Tetra Park warehouse, located in Singapore, has its Digital Twin implemented by DHL Supply Chain, ensuring all goods are correctly stored within 30 minutes of receipt. This smart storage solution tracks and simulates the physical condition and individual stock levels, allowing smooth non-stop coordination of all operations, making faults visible, improving safety and productivity in the warehouse (Galea-Pace, 2020).

4. Conclusions

The majority of the necessary infrastructure components and technology for the implementation of the concept of Digital Twins is being used in different fields in logistics. Digitalizing the assets is one of the most effective ways of gaining decisive competitive advantage in optimising logistics networks. Digital Twin is a promising opportunity to implement smart logistics, especially in the context of Industry 4.0 and Cyber Physical System, where modularity and autonomy are of pivotal significance. DT assists logistics systems in supporting operators and planners, ensuring rapid collaboration, transparency, enabling identification of bottlenecks and obstacles in the system, better decision making across multiple horizons, and clear visibility of the risk of a complex, interconnected supply chain. In other words, it supports the company to work more efficiently. The flow of goods depends on orchestration of various elements including containers, ship, trucks, information and communication systems, warehouses etc. Digital Twin is a solution, allowing analyzing this complex, multistakeholder environment in a more efficient, transparent and holistic way. Presented examples of implementation of the concept of Digital Twins in logistics are just a sample and need further research and assessment of the implementations' outcomes. However it gives greater understanding of the Digital Twins concept and what is more, the approach presented is an affordable inspiration for stakeholders to start a digital transformation. Kevin Williamson, CEO of RJW Logistics Group, considers that the pandemic context emphasized the obligation for data sharing. Juliann Larimer, President of Peak-Ryzer, highlights the need for further digitalization in logistics companies, since the COVID-19 crisis uncovered vulnerabilities in supply

chains, where processes were paper-based, with no real-time information (Arabe, 2020). It only proves the need for the exploration of potential and implementation of Digital Twin in logistics, accentuating it is now worth our while. One can notice that besides challenges and limitations of DT in logistics, such as a need of procuring and integrating indispensable sensors, being resource intensive and time-consuming, or difficulties in streaming the data from older equipment, as well as data protection problems, it has a capacity to transform and improve supply chain operations at all levels.

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PART II   IMPACT OF COVID-19 ON BUSINESS
AND SOCIETY DEVELOPMENT

The Impact of Crisis Phenomena and Risks on the Performance of Trade Enterprises

Anatolii Mazaraki, Tetiana Zubko

1. Introduction

The current situation in Ukraine, in particular in economic and political aspects, sharpens the issues of activity and development of enterprises operating in conditions of uncertainty and risks caused by it. The problems of risk management at trade trading enterprises have become more complicated, which requires their study and evaluation methods.

2. Formulation of the Problem

The research of current bases of risk management in the system of economic security of a trade enterprise and possibilities of their estimation under various types of risks.

3. Materials and Methods

In the course of the research there were used the scientific achievements of the following scientists: I. Blank, V. Dykan`, V. Vitlinsky, S. Ramazanov, G. Sytnyk, T. Lorentzen, A. Rhadziametovich, S. Herman, etc. Their achievements deal with the issues of risk assessment, crisis management, their connection with economic security of an enterprise. There were used the methods of systematization, comparative analysis, synthesis to perform the tasks and achieve the goal of the study.

4. Literature Review

The issues concerning the influence of risks and risk management are studied by economists from different countries. Most of the works concern the assess-

ment of financial risks in the banking sector. A group of Argentinian scientists such as J. Frost, L. Gambacorta, Yi. Huang, H. Shin, P. Zbinden (2019) studies the credit issues, credit risks and their impact on the financial stability and overall economic welfare based on the examples of financial services of the technological company "BigTech" in Argentina. Among the works related to the assessment of risk sources there should be noted the study by a group of Czech and Slovenian scientists J. Dvorski, Z. Petrakova, J. Polach (2019) who used questionnaires of 895 entrepreneurs from two European countries. Statistical hypotheses were assumed using a Z-score evaluation. The structure of crises and crisis management are investigated by the group of authors J. Bundy, M.D. Preiffer, S. E. Short (2016).

5. Results

Economic security of an enterprise depends on the impact of risks and crisis. The concept of economic security of an enterprise includes such concepts as: "threat", "danger", "crisis", "risks", "stakeholders' interests". At present, there are many works that reveal the essence, features of formation, typology and methods of evading (or leveling) these phenomena. The effects of the risks were considered in the works of the following scientists: V.V. Vitlinsky (2000, 2013), V.L. Dykan' (2011), S.A. Buruy (2006), Velukoivanenko G.I. (2000), O.L. Ustenko (1997), S.V. Ramazanov (2012), A. Boin, P. Hart, S. Capers (2017), P. Perrow (2005), J. Frost, etc. (2019). There are works which study the crises in social and economic systems at different levels. These are works in the field of both crisis management (Vitlinskyi, 2013; Lihonenko, 2016; Verchenko, 2000; Skitsko, 2013) and synergy (Adizes, 2018; Dykan', 2011; Zanh, 1999).

In the works of domestic and foreign economists, the concept of crisis at an enterprise has different interpretations. Now we will consider the definitions of "risk" and "crisis" by modern scientists (Table 9.1).

Table 9.1. Definition of "Risk" and "Crisis" by National and Foreign Scientists*

Definition	Essential features
1	2
A "risk" concept definition	
V.V. Vitlinsky, P.I. Verchenko (2000), V.V. Vitlinsky, S.I. Nakonechny (2002, p. 29): risk is an objective and subjective notion associated with overcoming uncertainty and conflict in a situation of inevitable choice and it reflects the degree to which the expected results, failures and deviations from the goals can be achieved, taking into account the influence of the controlled and uncontrolled factors	objective and subjective features, conflict, a measure to achieve the purpose

Table 9.1. cnt'd

Definition	Essential features
1	2
V.V. Vitlinsky (2000, p. 29): risk is an economic concept which reflects the peculiarities with which stakeholders of economic relations perceive the objectively existing uncertainties and conflicts, inherent processes of goal setting, management, decision-making, and evaluation that are all burdened with possible threats and lost opportunities	uncertainty, conflict, possibility of threat
S.M. Illyashenko (2015): risk should be considered as a possibility or a threat of deviation from the results of specific decisions or actions from the expected ones	degree of deviation of the result obtained from the result expected
O.L. Ustenko (1997, p. 31): …it is a pervasive phenomenon inherent to all market participants…	threat to enterprise performance
A "crisis" concept definition	
S.A. Buryi, D.S. Matsekha (2006, p. 10): crisis is the moment of resolving the contradictions which inevitably and suddenly appear in the process of organizations' activity, threaten their existence and require a rapid decision-making in case there might be a lack of resources	process of resolving contradictions at an enterprise
L.O. Lihonenko (2016): crisis is the reflection of a contradiction between performance and development of an enterprise	contradiction between the economic processes
A.D. Chernyavskyi (2006): crisis is a turning point in enterprise performance in which it is affected from the outside or inside, which requires a qualitatively new response from a company to overcome the threat of destruction. This is a situational characteristics of performance of any entity, which results from uncertainty in its external and internal environment	turning point, aggravation of a conflict situation
A. Boin (2017, p. 25): crisis is a product of general perception	phenomenon of perception of reality
K. Perrow (1999): crisis is an undesirable product of complex systems	by-product in an enterprise performance
G.O. Nadion (2010): crisis is an integral attribute of any development process and during this development, it accompanies the transition from one phase to another	component of development which is obligatory in order to avoid stagnation

Source: made by the authors using the sources (Boin, 2017; Buryi, 2006; Chernavskyi, 2006; Vitlinskyi, 2000, 2002, 2013; Hermann, 1963; Lihonenko, 2016; Illyashenko, 2015; Ustenko, 1997).

Functioning and development of many economic processes are uncertain in some aspects. Hence, there are situations that do not have a unanimous solution. If there exists probability of a certain situation, it will result in a risky situation (Hranaturov & Shevchuk, 2000, p. 24). A risky situation is associated with unstable processes.

Now we will name several modifications of risk:
■ the choice is made on the basis of objective estimates of the probability to obtain a certain result;
■ the decision is made according to the subjective assessments of the specified probability;
■ both objective and subjective assessments are taken into account.

An entrepreneur makes a choice and tries to implement it. This situation reflects the concept of risk which exists both at the stage of choosing a solution (an action plan) and at the stage of its implementation.

Risk which results from the uncertainty of the expected events in the process of achieving the goal may be explained in different ways. By its origin, the term "risk" (risque – French, risko – Italian) means "danger" and is considered as a possible danger, a random action of an entrepreneur hoping for a positive outcome. The actions associated with danger can be both unconscious (hope for luck) or conscious.

Among many proposed definitions, the definition of risk as a measure of danger that is often used in emergency situations, deserves the most attention. But it contains significant inaccuracy due to the fact that the concept of measure refers to strictly formalized mathematical or physical objects. Therefore, it is feasible to formulate the concept of risk in the following way: risk is a quantitative or qualitative assessment of danger.

As an economic category, risk means a feature of social and economic relations and is associated with decision-making in terms of uncertainty, which may lead to negative consequences.

Accordingly, the phenomenon of risk has several important interrelated elements that reveal its essence:

1. possibility of deviation from the desired purpose, for the sake of which the choice of one of the alternative solutions is made;
2. probability of achieving the expected result;
3. uncertainty in achieving the goal;
4. possibility of tangible, moral and other losses associated with the choice that is made with the alternatives in conditions of uncertainty.

Risk is characterized by three features: contradiction, alternative, uncertainty. We will specify the main causes of uncertainty, i.e. the sources of risk:

- spontaneity of natural processes, natural disasters;
- coincidence;
- antagonistic trends, collision of conflicting interests;
- probable nature of scientific and technological progress;
- incomplete information about an object or a process on which the required decision depends;
- scarcity of tangible, financial, labour and other resources needed for decision-making;

■ impossibility to explore the object clearly using the existing methods of scientific knowledge;

■ differences in social and psychological attitude, vision, intentions, assessments, commonly used types of behaviour;

■ imperfection of the main components of the economic mechanism: planning, pricing, logistics, financial and credit relations;

■ unexpected changes in legislation.

The occurrence of risk is determined by the stochastic nature of many processes, unpredictable and accidental circumstances, the variety of economic relations in which business entities act. The tendency of an economic agent to risk, in addition to own qualities, depends on:

1. the actions of other business entities operating in the external environment;

2. availability of resources (it is considered that the greater is the resource potential of an entity, the less sensitive it is to the risk and the more often it takes risks);

3. information (incomplete, variable or unreliable information reduces the willingness to venture).

As a rule, the decisions are not made in complete certainty and therefore the desired result might not be achieved.

Each enterprise has its own goals, uses its own strategy for successful performance and development. The chosen direction of development directly affects the risk management system. The strategy of enterprise development is formed taking into account the most possible types of uncertainty at each of its stages. Under such conditions, management of an enterprise is affected by internal and external factors.

The types of risks are interrelated and therefore require a profound analysis of their structure and causes. The effectiveness of risk management is largely influenced by the identification of their role and place in the overall classification system. The economic literature which is devoted to the study of such problems offers various ways to classify risks. The main elements underlying them include:

■ time of occurrence (retrospective, current, perspective);

■ main factors of occurrence (political, economic, natural disasters);

■ expansion (external, internal).

This classification can be supplemented by a number of features (Dykan`, 2011; Hranaturov, 2000; Kornyliuk, 2019; Kotsiuba, 2019; Lukianova, Shutiak, 2014; Ustenko, 1997) (Table 9.2).

Table 9.2. Classification of Risks According to Certain Features*

Classification features	Types of risks
1	2
Connection with business activity	Entrepreneurial risks, non-entrepreneurial risks
A country where a business entity functions	Internal risks, external risks
Level of occurrence	At company level (micro level), sectoral, intersectoral, regional, state, global
Sphere of origin	Social and political risks, administrative and legislative risks, production risks, financial risks, ecological risks, demographic risks, geopolitical risks
Causes	Uncertainty of future, incomplete information
The degree of reasoning the risk	Reasonable, partially reasonable, adventurous
The degree of systematization	Systemic risks or unique risks
Compliance with acceptable limits	Acceptable, critical, catastrophic
Implementation	Implemented or not implemented
Time of taking risks	Preventive, due, overdue
Activities of persons who respond to risk	Individual decision and collective decision
Time when a factor impacts	Short-term, permanent, systematic, periodic
The scale of the impact	Individual and collective
Ability to predict	Predictable and partially unpredictable
The degree of influence on the activity	Negative, ineffective, positive
The degree of consideration of the time factor	Indefinite (risks without time limits) or limited in time, among which there are long- and short-term risks
Prevalence	Common and unique
Frequency of damage	Sporadic risks, risks that occur sometimes, frequent risks
Amount of damage	Minor, bigger, grave or catastrophical

Source: * supplemented by the authors according to the sources (Ramazanov, 2012; Ustenko, 1997).

Some economists (Subach & Ligonenko) combine the understanding of a crisis with viability of an enterprise, comparing an enterprise with a living organism. L. Ligonenko (2016) notes that the cause of a crisis is decreased viability of an enterprise which emerges because of the increasing contradiction between its performance and development. This researcher identifies four main groups of indicators that testify to a crisis development:

1. the level of return on equity and the bulk of break-even activity;
2. ability to generate sufficient cash inflows in time in order to finance the operating and investment activities of an enterprise;
3. sufficient or insufficient bulk of assets and their liquidity to meet debt obligations;
4. the amount of net assets of an enterprise that meet the target parameters.

The state of issues concerning a crisis in enterprise activities was thoroughly considered by a group of authors (Ramazanov and others, 2012) and G.O. Nadon (2010, pp. 59–60), who emphasized several approaches (a subjective one, a situational one, an adaptive one, "ideal transition"). Each of these approaches has its advantages and disadvantages. This list should be supplemented by other three approaches – a historical one, a cyclical one and a synergistic one. Their features are given in the Table 9.3.

Table 9.3. Analysis of Approaches to Define Crisis in Enterprises' Performance

No.	Approach	Causes of crisis	Disadvantages of the approach
1	Subjective	Crisis is caused by the actions of government agencies and local authorities	Ignoring the internal processes at an enterprise
2	Situational	Crisis is caused by unfavourable conditions which require effective reforms and mobilization of national resources. Change of these conditions is time and money consuming	There is no clear determination of crisis factors
3	Adaptive	Crisis is caused by global changes that take place over a long time period, during which companies must adapt to new operating conditions	Such crises occur quite rarely and each of them requires elaboration a company's own response and adaptative measures
4	"Perfect transition"	An enterprise crisis is caused by internal and external processes that cause forced changes in enterprise performance	Attention is focused on managerial human factor and it is unlikely that external factors are taken into account
5	Synergetic	Enterprise crisis is caused by many internal and external factors, in particular, a phenomenon of cyclicity acts as another factor of influence	Economic systems and phenomena are usually described by nonlinear regression models. Therefore, the study of crises, threats and dangers should be determined using this method. There are no disadvantages
6	Historical	The history of human development has always been accompanied by crises which certainly had an impact on economic relations. Economic crisis is characterized as an imbalance between supply of and demand for goods and services	Is perceived as a regular phenomenon
7	Cyclic	According to the theory of cycles, crises in the economy occur every 11 years	It is impossible to predict the intensity or scale of a crisis and the place of its origin

Source: improved by the authors using the sources (Lukianova, 2014, p. 60; Yankovskyi, pp. 143–148; Seniushkyna, 2011, pp. 114–118).

A corporate crisis is manifested in opposition of enterprises' social and economic activities to the influences of the external environment. At the same time, a crisis can serve as an impulse for an enterprise's development and transition to a better condition. The consequence of a crisis at an enterprise is the final result of the impact of a crisis situation on the condition of the enterprise. The consequences can be both positive and negative.

According to A.M. Shtangret (2012, p. 5), crisis phenomena reflect changes in functioning of certain elements or parts of an enterprise. At the stage of emergence and development of crisis phenomena, an enterprise as a system operates according to the principle of self-preservation which ensures its return to the state of a previous equilibrium or leads to a new one. Other authors (Dykan` & Nazarenko, 2011, p. 34) distinguish the concepts of a crisis situation and a crisis state. A crisis situation is a significant increase in the number of interconnected crisis phenomena, resulting in a slight deterioration of certain indicators of an enterprise, while the whole system retains its ability of self-preservation (equilibrium). When the number of crisis phenomena increases – the system of self-regulation weakens and loses the ability to return to an equilibrium (Dykan` & Nazarenko, 2011, pp. 69–71). Then we can talk about transition to a crisis state. The state of crisis is considered to be the accumulation of differences or a discrepancy between the structure, activities, processes of an enterprise and the market situation; all this leads to a further increase in the number of crisis phenomena and deterioration of the financial situation (Dykan` & Nazarenko, 2011, p. 34; Shtangret, 2012).

In the works of economists there can be distinguished three stages of a crisis state (Table 9.4).

Crisis management is a subsystem of coprorate management. Dynamic market development, growing competition, threats and dangers create new demands for crisis management of an enterprise. "Crisis management is a well-organized complex managerial system, it is aimed at a prompt identification of the signs of a crisis and at creating appropriate conditions for its timely overcoming and prevention (in order to prevent violations in the enterprise activity that may lead to its bankruptcy), as well as avoidance of a crisis in the future" (Nadon, 2010, p. 70).

Among the whole set of factors influencing an enterprise, it is possible to identify the crisis-generating ones which cause crisis phenomena that can escalate into crises if there is no prompt response. These factors are threats and dangers to enterprises that affect the level of their economic security.

In enterprise performance, situations emerge when enterprise conditions are deteriorating and a crisis phenomenon, a crisis situation or a crisis state begin to develop. These conditions may be natural or artificial. Most changes in the external environment can be foreseen by the company's management. Predicted changes which were not taken into account by managers usually indicate their mistakes or lack of professionalism. Professional managers are able to anticipate changes in legislation, tax policy, changes in the activities of partners, etc. Unpredictable changes include unpredictable situations: revolutions, epidemics, catastrophes.

Table 9.4. Stages to Diagnose an Enterprise Crisis State

Stage	Characteristics	Measures to combat a crisis
1	2	3
The first stage	Decrease in profitability and production volumes, deterioration of a financial state, increase in inventories	– revision of the strategy which helps make or increase a profit; – revision of sales prices, reduction of wholesale prices, their optimization; – implementation of investment policy; – optimization of capital structure, increase in equity ratio; – analysis of possibilities of suppliers and quality of their products and the introduced innovations in the supply process if needed (replacement of uncompetitive suppliers); – rational use of tangible resources, introduction of economically feasible stock standards; – improvement of quick and reliable payment systems; – introduction of digitalization tools and templates; – minimization of commodity losses.
The second stage	Unprofitable enterprise, lack of working capital, reduction of production, overdue wages	– analysis of production costs in order to reduce them; – improvement of the organizational structure and its possible reduction; – modernization of personnel policy, improvement of information security and quality; – diagnosis of a crisis at early stages; – crisis prevention in the main areas; – improvement of quality of managerial decisions; – involvement of highly qualified specialists if needed; – use of foreign experience in developing corporate crisis measures; – rational use of financial resources; – strengthening of the competitive position; – reengineering; – regulating the procedure of imposing formal sanctions for violation of the agreed terms of payment (to expand the area of personal responsibility of managers for non-compliance with the individual and cooperative labor agreements, to impose bigger fines for the overdue wages, for causing bankruptcy of enterprises with overdue obligations for employees; and also to confer standby authority to labour inspections); – creation of a legislative mechanism which may help guarantee the payment of wages, implementation of the constitutional right of employees to have a priority in receiving wages that are overdue in case an enterprise going bankrupt; – creation of conditions that might increase the efficiency of economic activity of debtor enterprises;
The third stage	Enterprise insolvency, the risk of ceasing activity	– rehabilitation or liquidation of an enterprise; – the search for creditors, potential investors and new owners

Source: own work.

With regard to industrial and trading enterprises, we distinguish the following groups of risk factors: external risks and internal risks, which are interrelated and have a variable content (one or another type of risk may "move" from one group to another).

There are many methods of analyzing and measuring the level of risk. The combination of these methods gives reasonable determination and understanding of the risk level and, accordingly, allows to form a set of measures to

overcome it. Table 9.5 presents a generalized system of risks of an industrial and trading enterprise and the relevant indicators to assess them.

Table 9.5. The System of Risks in Performance of an Industrial and Trade Enterprise

Factors of risk	Methods and indicators of risk assessement
1	2
External factors	
Tax factor (stability of tax legislation)	Expert score estimation
Inflation factor (inflation rate)	Score estimation of inflation rate change, given in scores according to the experts' opinion; financial leverage (quantitative estimation)
Percentage factor (change of monetary policy and account rate of the National Bank)	Using a combination of a statistical method and an analogy method, the following indicators can be evaluated: rental rate on loan, a term of possible loan
Legislative factor (changes in law, adoption of licences, introduction of restrictions on production and activities)	Cost-effectiveness analysis is a quantitative measurement of costs that result from legal restrictions and comparison with enterprise performance
Price factor	Using a statistical method, one can determine the risk level based on the indicators of dispersion, variation index of turnover and profitability index
Currency risk (a change in the exchange rate both in the sale of finished products and imports)	Estimation of costs and losses
Competitive factor (actions of competitors, the risk of increased competition)	Using the evaluation of competitiveness level at an enterprise, one can draw a conclusion as to the riskiness of its performance
Risk of partnership (breach of partnership agreements, reduction of efficiency of international trade agreements, the risk of non-compliance with the terms of the contracts)	Estimation of costs and losses resulted from breach of agreements
The risk of noncompliance with the terms and amount of deliveries, package contents and range of products	Estimation of costs and losses
Risk of transportation: change of transportation rate, fuel prices, cases of accidental damage of baggage or its delays	Correspondingly a quantitative method of risk estimation is used (namely, an estimation of losses)
Risk of crimes in cyberspace	Estimation of costs and losses
Risk of time irregularity of economic cycles	Using the statistical method, one can determine the risk level according to the dispersion indicators and a turnover variation index
Commucation risk	Score estimation of experts, assessment of an enterprise competitiveness level
Internal factors	
Financial risk. It is the degree of uncertainty resulting from a relation of borrowed and own funds in order to finance an enterprise. This risk refers to reduction of the investment attractiveness of enterprises as well as inefficiency of a financial management system at an enterprise	Models of assessing financial security of an enterprise

Table 9.5. cnt'd

Factors of risk	Methods and indicators of risk assessement
1	2
Probability of insolvency or bankruptcy	Models of bankruptcy (the Matviychuk model, the Tereshenko model)
Technological risk (incomplete use of science and engineering progress achievements, inefficient management)	Increase in costs and reduction of profitability. A quantitative method of the risk assessment is used (calculation of costs and losses)
Commodity risk (inefficient quality of goods, high credit rates, inadequacy of a quality control system)	Expert score estimation and assessment of enterprise competitive level
Loss of image (risk of losing reputation of a brand in the eyes of partners, customers, employees)	Expert score
Informational risk (misrepresented information, lack of data about customers, about their reasons to buy, lack of information about production or trade capacities of an enterprise)	Expert score
Risk related to the use of fixed assets and current assets	Models of economic and financial state estimation
Psychological risk (poor discipline, incompetence of employees, conflicts and bad climate in labor collective, stress)	Expert score estimation and models of personnel security estimation
Risk of loss of professional employees	Models of personnel security estimation at an enterprise
Inefficiency of management structure of foreign economic activity of an enterprise	Decision tree method
Ineffective insurance system for export-oriented and commercial activities of an enterprises	Decision tree method
Inconsistency between an enterprise's marketing system and the existing market conditions	Expert score

Source: own work.

We want to emphasize that the indicators that assess financial and property state give wider characteristics of enterprise performance and possible risk factors.

Taking into account the above global trends, and relying on the analysis of scientific and practical sources and conceptual principles of this study, we propose to systematize modern risks of industrial and trading enterprises performance, into the following ones: financial, customer, internal processes, personnel management, environmental impact, innovation development.

Financial risks are characterized by the existence of threats associated with the disruption of the financial state of industrial and trading companies due to the changes in the economic situation in the country, increasing competitive risks and internal financial conflicts. Financial risks are associated with the deviation of financial indicators from the planned values: market values (systematic ones), financial state indices (specific ones), interest rates (strategic ones). It is believed

that financial risks are the most essential among the other business risks because the result of their occurrence is a direct loss and aggravation (losses) of economic activity. The main causes of financial risks at industrial and trading enterprises are external ones (cyclical economic development, integration and globalization processes, dynamic innovation changes, development of competitive environment) and internal ones (non-optimum capital structure, imperfect tariff policy, changes in consumer demand, improper internal financial risk management). Thus, financial risk management as a tool for creating financial security should be an urgent requirement to ensure financial stability of industrial and trading companies.

Personnel risks are determined by the personnel threats associated with the impact of social, motivational, professional, qualification, organizational and communication risks. It should be noted that due to human resources in the trade sphere an appropriate level of economic security of enterprises is assured simply because the necessary innate qualities, education, qualifications, professional knowledge and experience of employees determine the state and adaptation of all other functional components. Personnel risks are caused by the activity or inactivity of employees: staff turnover, misuse, capability to do harm or company's working conditions that are injurious to health (poor environmental conditions).

Customer risks are mostly characterized by reputational risks that arise when interacting with existing and potential customers: meeting obligations to customers, competition, changes in trends. Risks of internal business processes are, first of all, the risks in operating activity and they characterize the efficiency of business processes of an enterprise, such as production, organizational structure, information. Environmental risks are determined by five main groups: geopolitical, social, environmental, economic, technological.

Innovation and investment part of activity characterizes the activity of an organization in the implementation of new developments, attracting investment and is accompanied by risks in the course of implementation of investment and innovation projects. These risks are characterized by the following indicators: investment ratio, the level of innovative development of an enterprise, the level of preparedness to intoduce innovations, etc.

There are several stages in the risk management system of an enterprise: risk analysis (identification, determination of their impact, quantitative assessment and study of the causes); the choice of a risk response method (reduction, protection, risk aversion) depending on the area of origin; taking measures and monitoring them to respond to risk (Figure 9.1).

Figure 9.1. Measures for Risk Prevention and Minimization
Source: own work.

Risk management is an important element of an enterprise's economic security system. Economic security is characterized by the level of risk of an enterprise's activity; whereas the effectiveness of measures aimed at ensuring an enterprise's economic security is determined by the goal of reducing the risk in enterprise performance the optimal use of resources and sustainable development of an enterprise.

6. Conclusions

In current economic conditions which have a high level of economic uncertainty, it is impossible to attain strategic financial goals and provide long-term financial stability without creating an efficient system of strategic financial management which, in its turn, should obligatorily include mechanisms and systems of risk management. In order to function successfully, enterprises should not avoid risks, but assess their effect and importance properly, manage them in time, consider the risk factors while making managerial decisions, and adapt an enterprise's activity to the changes of internal and external environment.

The current situation in Ukraine, in particular in economic and political aspects, sharpens the issues of activity and development of enterprises operating in conditions of uncertainty and risks caused by it. The problems of risk management in trading enterprises have become more complicated, which requires their study and evaluation methods. Modern trends of increasing risks cases and their effect are explained by the influence of such factors as loss of position in the sales markets, decrease in customers' purchasing power, possible war and the existing epidemic.

We could confirm the correctness of our definition of risk and its components for manufacturing and trading companies based on the analysis of the sources in the field of the research. The set of risks depending on the nature of the factors that cause them can be divided into external and internal ones (the sources of these groups of risks are the events that occur both in the internal and external environment of a trading company).

The risks that threaten the economic security of an enterprise are determined during the research of the peculiarities in performance of industrial and trading enterprises in Ukraine in view of the European integration processes. It was established that one could determine the level of influence of one type of risk or another by combining several methods of risk analysis. According to the principle of classification of business processes by components of the improved balanced scorecard, the following risk factors (threats) are presented: a financial component, a client component, a component of internal processes, a personnel component, a component of external environment and a component of innovative development.

Future research will make it possible to improve enterprises' management systems, their risk resistance and can help choose efficient ways of giving recommendations to managenent.

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A Vision for EU Socio-Economic Recovery Post Covid-19 Pandemic

Andrzej Łączak

1. Introduction

The COVID-19 pandemic has caused the greatest global economic crisis that has been experienced since World War II. Never before has universal lockdown been used on such a scale. Certain countries imposed travel restrictions or even closed their borders. As a result, industries related to tourism, recreation and gastronomy suffered in the first place. It also had a negative effect on the food processing and agricultural industries (CME, 2020), as well as fluency of the supply chains (Wilson, 2020). Moreover, the pandemic caused falls on stock exchanges on all continents (Bachman, 2020). The main aim of this article is to identify effectiveness factors for the use of funds from the financial perspective 2021–2020 and NextGenerationEU. They will be decisive in fighting against the crisis caused by the COVID-19 pandemic.

2. Socio-Economic Situation in the Second Year of the Pandemic

The socio-economic situation is best illustrated by socio-economic indicators. Public debt in the EU increased on average to the level of 90.7% and in the Euro zone up to the level of 98% of GDP. In many countries, including highly developed ones, such as France, Belgium or Italy, it has significantly exceeded 100% of GDP. In comparison to 2019, public debt increased by an average of around 15% (Table 10.1).

The gross domestic product in the EU decreased on average by more than 6%. The greatest decrease, by almost 11%, was noted in Spain. In France and Italy it was over 8% and in Germany almost 5%. Of all the EU countries, only Ireland experienced a GDP growth of 3.42%. Luxembourg recorded a slight decrease, by 1.31%, and Poland by 2.69% (Table 10.2). An alarming phenomenon is also

Table 10.1. General government gross debt (percentage of GDP)

COUNTRIES	2015	2016	2017	2018	2019	2020
European Union - 27 countries (from 2020)	84.8	84.0	81.5	79.5	77.5	90.7
Euro area	90.9	90.1	87.7	85.7	83.9	98.0
Belgium	105.2	105.0	102.0	99.8	98.1	114.1
Bulgaria	26.0	29.3	25.3	22.3	20.2	25.0
Czechia	39.7	36.6	34.2	32.1	30.3	38.1
Denmark	39.8	37.2	35.9	34.0	33.3	42.2
Germany	72.3	69.3	65.1	61.8	59.7	69.8
Estonia	10.0	9.9	9.1	8.2	8.4	18.2
Ireland	76.7	74.1	67.0	63.0	57.4	59.5
Greece	177.0	180.8	179.2	186.2	180.5	205.6
Spain	99.3	99.2	98.6	97.4	95.5	120.0
France	95.6	98.0	98.3	98.0	97.6	115.7
Croatia	84.3	80.8	77.6	74.3	72.8	88.7
Italy	135.3	134.8	134.1	134.4	134.6	155.8
Cyprus	107.2	103.1	93.5	99.2	94.0	118.2
Latvia	37.1	40.4	39.0	37.1	37.0	43.5
Lithuania	42.5	39.7	39.1	33.7	35.9	47.3
Luxembourg	22.0	20.1	22.3	21.0	22.0	24.9
Hungary	75.8	74.9	72.2	69.1	65.5	80.4
Malta	55.9	54.2	48.5	44.8	42.0	54.3
Netherlands	64.7	61.9	56.9	52.4	48.7	54.5
Austria	84.9	82.8	78.5	74.0	70.5	83.9
Poland	51.3	54.2	50.6	48.8	45.6	57.5
Portugal	131.2	131.5	126.1	121.5	116.8	133.6
Romania	37.8	37.3	35.1	34.7	35.3	47.3
Slovenia	82.6	78.5	74.1	70.3	65.6	80.8
Slovakia	51.9	52.4	51.5	49.6	48.2	60.6
Finland	63.6	63.2	61.2	59.7	59.5	69.2
Sweden	43.7	42.3	40.7	38.9	35.0	39.9

Source: Eurostat.

the increase in unemployment, which on average in the EU amounted to 7.1% and in the Euro zone to 7.8% in 2020. All governments decided to save their finances by increasing their budget deficit. On average in 2020, the deficit in the EU was 6.9% and in the Euro zone: 7.2%, while in 2019, it was 0.5% on average in the EU and 0.6% in the Euro zone. The crisis has also increased the unemployment rate in almost all EU countries. The exceptions are Greece, France and Poland. Though it is worth noting that in the first two countries the unemployment rate

was high and amounted to 16.3% in Greece and 8% in France in 2020. In Poland, it was 3.2% and decreased by 0.1% compared to the previous year (Table 10.2).

Table 10.2. Main economy indicators in 2020 in %

COUNTRIES	GDP compare to 2019	Inflation	Unemployment	Budget balance
European Union - 27 countries (from 2020)	−6.08	0.7	7.1	−6.9
Euro area	−6.52	0.3	7.8	−7.2
Belgium	−6.28	0.4	5.6	−9.4
Bulgaria	−4.15	1.2	5.1	−3.4
Czechia	−5.60	3.3	2.6	−6.2
Denmark	−2.73	0.3	5.6	−1.1
Germany	−4.77	0.4	3.8	−4.2
Estonia	−2.93	−0.6	6.8	−4.9
Ireland	3.42	−0.5	5.7	−5.0
Greece	−8.25	−1.3	16.3	−9.7
Spain	−10.84	−0.3	15.5	−11.0
France	−8.11	0.5	8.0	−9.2
Croatia	−8.03	0.0	7.5	−7.4
Italy	−8.87	−0.1	9.2	−9.5
Cyprus	−5.10	−1.1	7.6	−5.7
Latvia	−3.62	0.1	8.1	−4.5
Lithuania	−0.87	1.1	8.5	−7.4
Luxembourg	−1.31	0.0	6.8	−4.1
Hungary	−4.96	3.4	4.3	−8.1
Malta	−7.80	0.8	4.3	−10.1
Netherlands	−3.74	1.1	3.8	−4.3
Austria	−6.26	1.4	5.4	−8.9
Poland	−2.69	3.7	3.2	−7.0
Portugal	−7.57	−0.1	6.9	−5.7
Romania	−3.86	2.3	5.0	−9.2
Slovenia	−5.53	−0.3	5.0	−8.4
Slovakia	−4.75	2.0	6.7	−6.2
Finland	−2.77	0.4	7.8	−5.4
Sweden	−2.77	0.7	8.3	−3.1

Source: Eurostat.

Compared to 2019, the European economy recorded a significant decline in industrial production and all EU countries recorded a decline in production. In 2020, the average industrial production in the EU was at 97.2% and in the

Euro zone at 95% of the 2015 level. The economies of Germany, France and Italy shrank to 90.5%, 92.5% and 93.3% of 2015 production, respectively (Table 10.3).

Table 10.3. Production in industry (2015=100%)

COUNTRIES	2015	2016	2017	2018	2019	2020
European Union - 27 countries (from 2020)	100.0	101.8	105.2	106.5	105.7	97.2
Euro area	100.0	101.6	104.6	105.4	104.0	95.0
Belgium	100.0	104.5	107.5	108.7	114.0	109.7
Bulgaria	100.0	102.5	106.6	106.9	107.5	100.9
Czechia	100.2	103.3	110.2	113.6	113.2	105.1
Denmark	100.1	103.8	106.2	108.7	111.6	105.0
Germany	99.8	100.9	104.3	105.3	100.8	90.5
Estonia	100.0	103.0	107.3	112.5	120.3	113.1
Ireland	100.0	101.8	99.5	94.6	97.3	101.4
Greece	100.0	102.6	106.9	108.8	108.0	105.6
Spain	100.0	101.7	105.0	105.4	106.0	95.6
France	100.0	100.5	102.8	103.4	104.0	92.5
Croatia	100.0	105.0	107.1	106.0	106.5	102.9
Italy	100.0	101.9	105.6	106.5	105.3	93.3
Cyprus	100.0	109.1	117.9	126.0	131.0	121.5
Latvia	100.0	104.7	113.8	116.1	117.0	115.0
Lithuania	100.0	102.7	109.7	115.4	119.3	116.5
Luxembourg	100.0	99.7	103.4	102.3	99.1	88.5
Hungary	100.0	100.7	106.1	110.1	116.3	108.0
Malta	100.1	92.8	100.9	102.4	103.5	103.2
Netherlands	100.0	101.3	102.7	103.3	102.4	98.1
Austria	100.0	102.1	108.0	113.3	113.3	106.2
Poland	100.0	103.1	110.2	116.6	121.6	119.0
Portugal	100.0	102.4	106.1	106.2	103.9	96.3
Romania	101.1	104.2	113.2	118.1	114.3	103.7
Slovenia	99.3	106.8	115.4	121.6	125.0	117.2
Slovakia	100.0	104.6	108.1	112.8	113.4	103.0
Finland	100.0	104.1	107.6	111.2	113.0	109.6
Sweden	100.0	101.6	106.5	109.4	111.8	106.8

Source: Eurostat.

Due to the difficult situation, on October 9, 2020, the Member States agreed on the budget for the recovery fund (European Commission, 2020f).

3. EU Vision of Overcoming the Crisis

Faced with a crisis on such a scale, EU countries are not able to deal with its consequences on their own. It has become clear to all European leaders that there is a need for EU level intervention. The establishment of the European recovery plan, known as the Recovery and Resilience Facility, coincided with the implementation of the new EU financial perspective for 2021–2027. Thanks to the cooperation, the EU countries have the amount of over 1.8 trillion euro at their disposal.[1] These funds are intended to contribute to the recovery of the EU economy and making it more resilient in the future. The Multiannual Financial Framework is aimed at farmers, businesses and the research and development sector (Table 10.4).

Table 10.4. Multiannual Financial Framework 2021–2027 nad NxtGenerationEU (2018 prices, in bilion euro)

	WRF	NextGenerationEU	RAZEM
1. Single Market, Innovation and Digital	132.8	10.6	143.4
2. Cohesion, Resilience and Values	377.8	721.9	1 099.7
3. Natural Resources and Environment	356.4	17.5	373.9
4. Migration and Border Management	22.7	–	22.7
5. Security and Defence	13.2	–	13.2
6. Neighbourhood and the World	98.4	–	98.4
7. European Public Administration	73.1	–	73.1
Total	1 074.3	750	1 824.3

Source: European Commission.

Among seven categories supported under the Multiannual Financial Framework, three will also be supported under the Reconstruction Fund. Most of the funds will be allocated to Cohesion, Resilience and Values (Table 10.5).

The reconstruction fund will be implemented in the form of grants and loans. 338 billion was allocated to grants and 385.8 billion to loans. Within the scope of these funds, 7 goals will be realized:
- Power up – Clean technologies and renewables,
- Renovate – Energy efficiency of buildings,
- Recharge and refuel – Sustainable transport and charging stations,

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[1]   2018 prices.

Table 10.5. Allocation in intervention area (current prieces, in bilion euro)

No.	Area	Multiannual Financial Framework 2021–2027	NextGenerationEU	Detailed area
1.	Single Market, Innovation and Digital	149.5	11.5	Research and innovation
				European strategic investments
				Single market
				Space
2.	Cohesion, Resilience and Values	426.7	776.5	Regional development and cohesion
				Recovery and resilience
				Investing in people. social cohesion and values
3.	Natural Resources and Environment	401	18.9	Agriculture and marime policy
				Environment and climat action
4.	Migration and Border Management	25.7	–	Migration
				Border management
5.	Security and Defence	14.9	–	Security
				Defence
6.	Neighbourhood and the World	110.6	–	External action
				Pre-accession assistance
7.	European Public Administration	82.5	–	–
	Total	1210.9	806.9	–

Source: European Commission (European Commission, 2021).

- Scale up – Data cloud and sustainable processors,
- Connect – Roll-out of rapid broadband services,
- Modernise – Digitalisation of public administration,
- Reskill and upskill – Education and training to support digital skills
  Additionally, € 83.1 billion was allocated from the Reconstruction Fund to:
- React-EU,
- Just transition fund,
- Rural development,
- Invest-EU,
- Horizon Europe,
- RESCEU.

Investments made in EU countries must be in line with the EU's priorities for green and digital transformation (European Commission, 2020g). These

priorities have been identified as key to Europe's future prosperity and resilience under the European Green Deal (European Commission, 2019) and in the 'Shaping Europe's Digital Future' roadmap (European Commission, 2020). Due to its potential for growth and creation of workplaces, green and digital transformation is now considered more important than ever (Unsworth, Andres, Cecchinato, Mealy, Taylor, & Valero, 2020). All Member States are obliged to present their plans for the use of EU funds. As a consequence, a wide-ranging internal consultation was launched with all regional, local and industry parties. It was months after when they reached the agreement, confirming the difficulty of the whole process. The ratification of the Initiative introducing the recovery program was not completed until May 2021. It is worth noting that in the event of a pandemic, the response time is of paramount importance for the economy.

4. Conditions for the Recovery of the EU Economy

It seems that in the face of the current economic situation, it is crucial to find an answer to the question on how to use the funds of the new financial perspective 2021–2027 and NextGeneratioEU most effectively. Whether the success will be achieved is contingent on numerous and complex factors. First of all, on the appropriateness of aims' selection, the timeliness of their implementation (Crescenzia R., Giuab M., Sonzogno GV, 2021), budget flexibility, simplification and shortening of procedures and the capacity of public administration (Papagni, E., Lepore A., Felice E., Baraldi AL, Maria Rosaria Alfano MR, 2021). It is a difficult and complicated task. When setting goals to be achieved, several factors should be taken into consideration.

At present, the discussion revolves almost entirely around the size of the funds allocated to saving the European economy. Unfortunately, it is forgotten that the money itself, even in the largest quantity, does not guarantee success. Even the largest funds allocated to incorrectly selected goals or the ones that do not guarantee the sustainability of the results achieved, as well as the ones implemented with a delay of several years, will have a much smaller impact than expected. It can be concluded that the more funds spent in the shortest possible time on properly selected goals, the greater the effect. In other words, the fight against the crisis may only be won by the one who spends the available funds for carefully chosen goals as quickly as possible and only if they are able to guarantee their sustainability. In order to achieve this, it is necessary to properly evaluate all factors responsible for success. From this perspective, the amount of funds is only one of the components, and what should be noted is that it does not constitute guarantee of success (Table 10.6).

Table 10.6. Effectiveness factors for the use of funds from the financial perspective 2021–2020 and NextGenerationEU

No.	Success factor	Evaluation Criteria	Assumptions to be assessed
1.	The accuracy of the choice of goals	Does the goal match the identified needs Assessment of the necessary resources to achieve the goals – the lack of resources will not allow the goals to be achieved	Convergence with the goals pursued in previous perspectives Assessment of the durability of similar projects implemented before
2.	Timeliness of project implementation	The resources necessary to implement the projects Previous experience in implementing similar projects	Assessment of the timeliness of the implementation of similar projects in the past Delays in the implementation of similar already completed projects
3.	The flexibility of the EU budget	Has an efficient system of funds' reallocation between priorities and objectives been developed Are Member States prepared for its implementation	Analysis of the reallocations implemented so far The time needed for the transfer of funds so far
4.	Simplification and shortening of procedures	Are there currently defined methods to simplify project selection Will the procedures be developed at EU or Member State level	Assessment of the procedures so far Time for selecting projects (from the call for proposals to signing the grant agreement)
5.	Administrative capacity of a Member State	The time necessary to prepare the competition and select projects (from the preparation of the recruitment regulations to the signing of the grant agreement) Possibilities of employing qualified staff	Proper assessment of the resources available – human and technical Management systems owned (IT)

Source: Own work.

The accuracy of the choice of goals should reflect not only the needs, but also the possibilities of implementing projects that could satisfy them. In the absence of such possibilities, their implementation should be abandoned in favor of projects partially meeting the needs, but sure to be implemented successfully. This will allow partial attainment of goals, but will ensure sustainability and will be the basis for achieving the desired goals in the future. Timeliness of project implementation is one of the most important factors determining success or failure. Changing the schedule and extending the project implementation time significantly reduces its effectiveness. From the point of view of program and project management, the lengthy budget amendment procedure is a significant drawback. In a pandemic situation, though, speed of response is very important. Therefore, the procedures for spending funds under the programs should allow for its considerable flexibility, allowing it to respond to emerging needs. The complex procedures that require the beneficiaries to engage significant human and financial resources constitute a drawback of spending funds. Fulfilling all the requirements is also very time consuming. Moreover, the preparation of competitions and their conduct often takes many months. Undoubtedly, it also depends on the potential of the administration (Table 10.6). The improvement of manage-

ment would be positively influenced by a reduction of management levels, which extend the decision-making process, e.g. intermediary institutions, the role of which is fulfilled by regional authorities or agencies, labor market institutions, etc. (Lavagnon, AI, et al. 2020).

5. Conclusion

Balancing between success factors is aimed at finding the right path to achieve goals and obtain the best results. There is no doubt that the entire EU needs to think carefully about how to improve governance and to make its approach more flexible in terms of freedom to decide on changes and redeployment of resources. A lot is also to be done on the part of the Member States. The effectiveness of using EU funds will be the result of the proper selection of goals and the pace of spending the funds, which will translate into the achievement of project results. On the other hand, the right choice of goals should guarantee the project's sustainability. One of the most important factors influencing the pace of fund disbursement is the improvement of the management system. Undoubtedly, limiting the number of management levels is necessary. The involvement of multiple management levels, especially in the context of weak administrative capacity in some Member States and their regions, can add to the complexity from the very beginning of the implementation process. The research conducted so far shows that the high management level entails slow pace of project implementation (Bachtler, Mendez & Wishlade, 2020). National coordination proved to be the most effective (Arbolino, DiCaro, & Marani 2020).

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Pivoting in Innovative Startups During the Covid-19 Pandemic

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1. Introduction

Innovation allows firms to test innovative methods or upgrade existing ones and explore alternative business opportunities by setting up new sectors, activities and products, and exploiting complementary resources and capabilities (Teece et al., 1997). Indeed, leveraging innovation becomes a critical factor in building, acquiring, transforming and/or reconfiguring capabilities, in line with external and internal challenges and vulnerability of the dynamic competitive environment (Teece et al., 1997; Eisenhardt & Martin, 2000; Teece, 2012). During the Coronavirus Disease 2019 (COVID-19) global pandemic crisis, many startups have tried to use and develop a model of innovation mainly problem solving, by changing their business models, modifying products or services and generating alternative technological solutions oriented to satisfy emergent market demand and to capitalize on unexplored opportunities (Kuckertz et al., 2020). As a result, they have played a relevant role in the definition and implementation of rapid responses to this unprecedented exogenous shock affecting large parts of the global economy (Giones et al., 2020; Morgan et al., 2020; Manolova et al., 2020), in general, and dramatically impacting on startups' existence, survival and growth (OECD, 2020), in particular. Emblematic in this direction is the pivoting actions defined and implementing by startups: launching or adapting products (i.e., snorkelling masks to be used for oxygen provision in hospitals), developing a large range of health services, focusing on new business opportunities that may arise during and after the pandemics (OECD, 2020). Hightech – and non-high-tech – startups have increased or pivoted their production to meet the demand for complex medical devices or components (Di Minin et al., 2021). Spe-

cifically, pivots are intended as temporary changes while, in others, innovation is the opportunity to experiment with new value generation processes beyond the COVID 19 crisis.

Indeed, the term pivoting collects several changing opportunities linked with products, business models, and the engine of growth, deriving from strategic decisions shortly modifying one or more elements which were, evidently, the reason for a failure (Ries, 2011).

This underlines that startups are better prepared to cope with the COVID-19 crisis than other types of firms since "being innovative is a precondition of being resilient, as innovative businesses tend to constantly and continuously anticipate and adjust to a broad range of crises" (Kuckertz et al., 2020, p. 3). Additionally, in this context, governments are issuing different measures to protect startups affected by the COVID-19 crisis. The most effective are tax incentives, advantages supporting short-hour working, grants and special programs such as growth loans and co-investment schemes. Although developed to address COVID-19, they could represent an appropriate opportunity to help innovative entrepreneurship also in the long period.

With this premise, the paper intends to explore the importance of pivoting for innovative startups by providing a complete framework of different conceptualizations, theories and research streams. To this extent, the paper analyzes the state-of-the-art literature on pivoting in the different research fields and deepens, through exploratory analysis, the pivoting phenomenon in the context of innovative startups facing the COVID-19 pandemic. The results highlight trends and gaps in a research field not yet fully explored and identify evidence useful to understand the determinants of pivoting.

2. Methodology

This study follows mainly the principles of systematic review proposed by Tranfield et al. (2003). Specifically, the literature review approach intends to identify scientific contributions to researchers (in the data-gathering process) and then to describe the choice of relevant publications and the preparation of the research report. This review follows different stages to be systematic, transparent and replicable (Transfield et al., 2003; Keupp et al., 2012; Greer & Lei 2012; Christoffersen 2013).

In the first step, the publications indexed in three English language databases (Scopus, Web of Science, SpringerLink) were searched, having as the last reference period the 15th of May 2021. The basic search string, firstly used on Sco-

pus, was (TITLE-ABS-KEY (pivot* AND NOT pivotal) AND TITLE-ABS-KEY (startup* or start-up*)). The string was adjusted following the specific requirements of the other databases. No limitation of time is considered, neither an exclusion based on publication typologies is done because, given the relative novelty of the phenomenon, we intended to find papers shared in the scientific community, regardless of the type. For this reason, the secondary documents highlighted on Scopus were also considered reliable sources in peer-reviewed papers. On Scopus, 94 primary documents and 33 secondary documents are found, on Springer 824 documents, while on WoS, retrieved publications are 55.

In the second step, the results were exported in .csv format, were controlled to make sure duplicate entries will be removed from the file and were analysed using the VOSviewer software (van Eck & Waltman, 2010) to identify the co-occurrence pattern of words and highlight the relationships between the keywords used by the authors of the scientific documents identified (VanEck & Waltman, 2017). The outcomes of the co-occurrence analysis of all the keywords used by the authors of published articles in the field showed that there are 851 keywords, 120 of which meet the threshold of a minimum of 2 occurrences.

Given the obvious possibility of misunderstandings in the interpretation of the term pivot or the concept of startups, to focus the attention only on documents related to our topic, a screening based on the keywords was carried out.

In this phase, in addition to the keywords strictly related to the topic of pivoting in start-ups, those concerning the current pandemic, the object of our analysis, were also included, while those concerning the methodologies and specifications of other research areas detached from our context were excluded. At the end of the sorting, 66 keywords were identified (Figure 11.1) that characterize the scientific landscape of our phenomenon (Figure 11.2).

Of the seven clusters identified, our work focused on publications that fell on cluster 3 (light green), i.e. the one that fully encompasses the co-occurrences between the analysis of pivoting processes, start-ups and the context of the covid-19 pandemic.

EBSCO host (Business Source Premier) was used as the main database for the literature search. Journals not available on EBSCO were searched manually via Scopus, ScienceDirect, Google Scholar and other research sources. After the cut of the broad pool of the initial list following inclusion and exclusion criteria (Rashman et al. 2009; Wang and Chugh 2014), a textual analysis of all retrieved contributions is done.

Selected keyword	Information Systems	Product Ideas
	Information Use	Products And Services
	Innovation	Project management
Business Development	Innovation Management	Sales
Business Model	International New Venture	Software Startup
Business Model Design	Lean Global Start-up	Software Startups
Business Model Designs	Lean Startup	speed
Business Model Development	Lean Start-up	Startup
Business Model Impact	Lean Startup Approaches	Start-up
Business Model Innovation	Learning Systems	Startups
Business Modeling	Life Cycle	Start-ups
Business Models	Minimum Viable Product	Start-up companies
Commerce	Modelling	Success
Covid-19	Models	Supply chains
Customer development	Negative Customers	Sustainable Business
Decision Making	New Business Models	Sustainable Development
Design	Pandemic	Technological Development
Digital Entrepreneurship	Pandemics	Technology Entrepreneurship
Digital Startups	Pivot	Technology Pivot
Economic And Social Effects	Pivoting	Technology Pivots
Entrepreneur	Pivots	Technology Transfer
Entrepreneurial Opportunities	Problem Solving	Validated Learning
Entrepreneurship	Product design	Value Proposition

Figure 11.1. Selected keywords
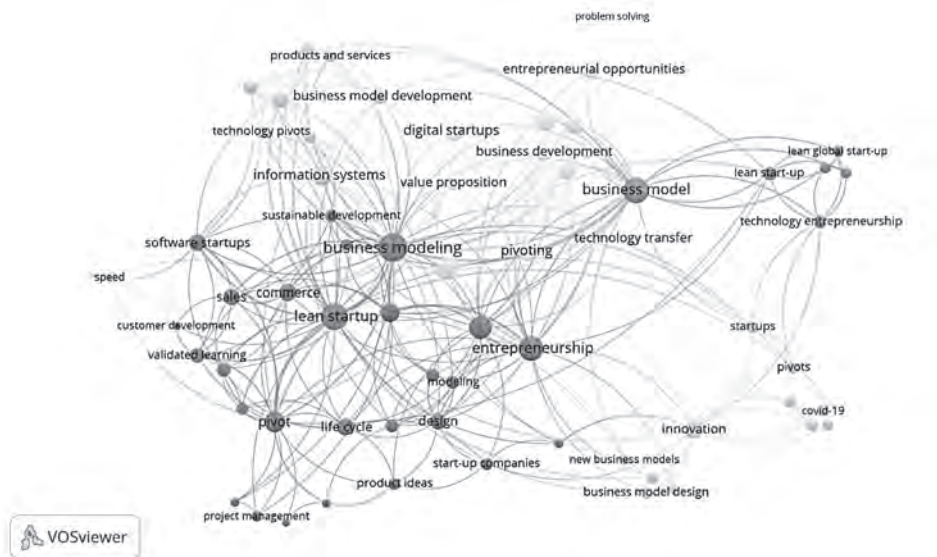Source: our elaboration.

Figure 11.2. VOSViewer Network visualization (items:66; minimum frequency:2; weight: link)
Source: our elaboration.

3. Conceptualization

The term pivot to highlight changes related to products, business models, and the engine of growth was first used (2009) and better developed (2011) by Ries, who came out with the analogy with basketball, when players usually keep one foot planted why moving the other. He presents ten different types of pills which could be taken into consideration by startups: *zoom-in*, when a single feature of a product becomes the whole product; *zoom-out*, when, on the contrary, the whole product becomes a single feature of a much larger product; *customer segment*, if a startup comes across a different segment of customers while solving the right problem; *customer need*, if a startup finds out that the problem which it is trying to solve is not so relevant for customers as other problems; *platform pivot*, if an application is transformed into its supporting platform or vice versa; *business architecture*, if a startup switches it; *value capture*, in case of changing it; *engine of growth*, in case of significant changes in its growth strategy; *channel pivot*, if a startup identifies a more effective way to reach its customers than its previous one; *technology pivot*, when a startup achieves the same goal by using a different technology.

Over the following years, several definitions have been proposed in the literature. Some authors consider it strictly related to a business model, but not in a compulsory way (Blank & Dorf, 2012; Maurya 2012). Nevertheless, there are still different opinions about what is pivoting, apart from the conclusion that it consists of a strategic decision that leads to the significant change to one or more, but not all, elements of a startup: product, entrepreneurial team, business model or engine of growth (Bajwa et al. 2017). However, the attention of academics has been focused on pivoting, especially in the last two years, showing that the topic is still in development. A recent study (Flechas Chaparro & de Vasconcelos Gomes, 2021) by analysing the most recent papers concerning it, makes it clear that there are five broad categories of private conceptualizations: a type of change; a type of strategic decision; a mechanism related to correction or replacement in case of failure; a process or an event and the state or condition.

Nevertheless, the previous study highlights different perspectives and a fourfold classification: *pivot design, cognitive, negotiation* and *environmental*. Finally, the authors propose a different definition of pivoting consisting of a strategic decision – made after a failure of one or more elements of the current business model – that is in the entrepreneur's hands, who force the startup to change the course of action body by reconfiguring the results and shortly modifying one or more elements of the aforesaid business model.

4. Theories

Within the literature focused on strategic change, the theoretical perspective known as *effectuation theory* is primarily developed to analyze the changes in their strategies that startups consider and implement against COVID-19. The reasons related to the use of effectuation logic are different. Primarily, since effectuation approach particularly well in a significant unpredictable environment or the face of under highly uncertain conditions (Giones et al., 2020). Secondly, the effectuation approach is appropriate to describe the entrepreneurial processes in dynamic, non-linear and resource-scarce environments (Fisher, 2012). Indeed, using effectuation logic facilitates the entrepreneur to understand several potential effects, to evaluate alternative strategies and to change the strategic directions restructuring activities, resources and capabilities. In this respect, effectuation entrepreneurs are oriented to control the state of space, rather than estimating it, by integrating unpredicted contingencies (e.g., environmental turbulence, resource scarcity) and imagined failures in the process of creation (Mäkimurto-Koivumaa & Puhakka, 2013). Finally, the effectuation approach is observed as a critical logic of action in contexts with high environmental uncertainty. It follows that undesired circumstances are considered a source of information and feedback for the (re-)define innovative business models (Hensel & Visser, 2019). Specifically, the effectuation theory assumes that entrepreneurs utilise the resources to meet the demands of the market in a flexible manner (Sarasvathy, 2001). In this respect, effectuation refers to "a particular way of articulating one's actions, which also considers such things as the context in which these actions take place, the resources one has, the constraints one may face, and the aims, goals, and ends one might pursue given all this" (Grégoire & Cherchem, 2020, p. 622). Looking at the entrepreneurial decision-making process, the aim of 'effectuators' becomes to achieve the best possible strategic results from leveraging the available resources and controlling the environmental uncertainty through creating new markets, products, and opportunities (Shirokova et al., 2020). As underlined by Giones et al. (2020), in this context the frugality may be a particular "mindset in helping entrepreneurs to bounce back from the economic hardships caused by the COVID-19 pandemic" (p. 3), orienting towards self-sufficiency, resilience and resourcefulness. This latter stimulates creative behaviours of making-due with existing resources to build possible innovative products and services and facilitates opportunity recognition and exploration (Giones et al., 2020; Flechas Chaparro & de Vasconcelos Gomes, 2021). Indeed, without the ability to consider different paths forward and pivot mobbing from the existing and/or acquiring resources, entrepreneur who is less frugal in times of high uncertainty and turbulence may be at a substantial disadvantage in both recognizing and seizing profitable business opportunities, which have to fit with

the capabilities of the firm (Morgan et al., 2020). On the other hand, it is evident by the scientific contributions that resource-based view theory (Barney, 1991) is primarily contemplated to examine pivots in startups because resources "are needed for potentially more value-creating activities such as speeding up new product development, closing customer contracts, or directly interacting with investors" (Giones et al., 2020, p. 3). In particular, the response to adversity is mainly based on the different combination and application of available internal resources and the possibility to use external resources linked to the network (Kuckertz et al., 2020) for exploiting emerging opportunities. This requires an experimental approach (Morgan et al., 2020) focused on continuous trial-and-error learning mechanisms to make a strategic change or add strategic elements and pivot.

5. Covid-19 Impact on Startups Business Model and Pivot

Innovative startups, for many years, have proven to drive productivity, being by nature dynamic, adaptable and resilient, dealing well with crisis, constantly and continuously by anticipating and managing its effects (Hamel & Valikangas, 2003; Linnenluecke, 2017).

As a result, they are capable of pivoting quickly to cope with changes in critical circumstances.

The current global pandemic involves significant challenges for startups and relevant opportunities for entrepreneurs (Marks, 2020; Giones et al., 2020; Kuckertz et al., 2020; Manolova et al., 2020; Reardon et al., 2021). Indeed, the need to get over the initial economic shock caused by disrupted supply chains and crashes in demand has been frequently poured into pivoting decisions (Laur et al., 2021; Morgan et al., 2020; Reardon et al., 2021).

Exploring the COVID-19 impact on women business, Manolova et al. (2020) find that most of them changed their strategy to deal with uncertainty. Women entrepreneurs quickly pivoted their business model by both cost-cutting and capturing new business opportunities presented by the recent crisis with online services and sales, online marketing, and better financial management. They pivoted to a new model identifying ways to apply their resources and capabilities (Manolova et al., 2020).

For startups dealing with uncertainty is a normal part of business, even the uncertainty in times of COVID-19 pandemic. Therefore, startups adapt their business models and pivot during a crisis as a winning strategy (Morgan et al., 2020). Giones et al (2020) highlight some ways that entrepreneurs can act in the evolving pandemic for pivoting; entrepreneurs could divest from goods and services or resources that do not contribute to primary revenue streams, maintain-

ing and acquiring goods, services, or resources that contribute to revenues, reducing short-term liabilities, and renegotiating financial expenses.

Some theoretical and empirical studies developed in the COVID-19 context focused on sectors such as food (Rowan and Galanakis, 2020; Reardon et al., 2021), entertainment and digitization services (Morgan et al., 2020), entrepreneurial opportunities related to health (Laur et al., 2021).

During the COVID-19 pandemic, several software developers and service providers have evaluated new business opportunities (Morgan et al., 2020). According to Woodford (2020), many European startups pivoted to health and health care offering coronavirus tests, making sanitary equipment, producing, and selling surgical masks or lockdown-related packages. A startup repurposed its machine learning systems to dream up treatments for coronavirus (Field, 2020). Laur et al. 2021 provide a concrete example of how rapid adaptive leadership strategies in health care can support key results in times of uncertainty allowing the needs of patients to be met through different pandemic waves.

There have been various decision-making alternatives for pivoting the business model, by leveraging resources and capabilities to move into a related product category, as in the case of local distilleries pivoted to hand sanitiser (Woodford, 2020) or changing distribution channels to reach customers in new ways; compared to many traditional competitors shut during the lockdown, some fitness startups pivoted to online success (Morgan et al., 2020), optimizing sports training from home (Coleman, 2020). In the entertainment sector, some startups quickly pivoted from offering in-person services to full-digital, i.e., online services for recorded musical messages, online video tutorials and delivering painting kits to customers' doorsteps in advance, online lessons for children on sustainability and energy, online shop for helping artists sell their work (Coleman, 2020; Woodford, 2020).

Other startups pivoted their way out of the COVID-19 crisis in the food sector, tasting wine online (Coleman, 2020). Reardon et al. 2021 examine two forms of pivoting in a developing country food supply chains: pivoting to e-commerce of food industry firms and the copivoting by delivery intermediaries to facilitate the pivoting by food industry firms and thus take advantage of new opportunities. The pandemic led many of these intermediaries to intensify and expand their operations. This was crucial to the ability of the food-industry firms to pivot flexibly. The pandemic induced this set of fast-tracking innovations, accelerating the diffusion of e-commerce and delivery intermediaries, and enabling food industry firms to redesign their supply chains to be more resilient, and contributing to food security (Reardon et al., 2021).

COVID-19 changed startups' business model, switching to one more sustainable and that could generate cash in the new context; pivoting to be more

competitive with new strategies including flexible human resource practices, cost reduction, enhancing customer relations (Alves et al., 2020; Leprince-Ringuet, 2020). This current pandemic has emphasized how firms need to pay attention to learning for the long term (Alves et al., 2020).

6. Discussion, Future Research Directions and Conclusions

This paper contributes to the entrepreneurial action literature by reviewing the research on the pivoting decisions adopted by startups during the COVID-19 pandemic. Therefore, it adds to the current academic debate in the management literature, concretely highlighting, due to a systematic analysis of the most recent literature, the importance of pivoting for innovative entrepreneurship by underlining its capability of getting over disruption and transform it into an opportunity quickly rethinking and redesigning a business model, to supply chains and safeguarding employment (Coleman, 2020; Woodford, 2020; Reardon et al. 2021). In addition to this, it describes some examples of business owners who are innovating to continue services and the resulting models emerging from their choices suitable to change society for the better (Morgan et al., 2020).

Concerning future research directions in response to COVID-19, governments offered unprecedented financial and tax support to assist businesses and protect jobs, by relaxing temporarily tax compliance obligations, pausing or suspending audits and court hearings. Furthermore, the European Union has decided to prolong until 31 December 2021 the State Aid Temporary Framework adopted on 19 March 2020 and to expand its scope by increasing the ceilings and allowing the conversion of certain repayable instruments into direct grants until the end of next year. Therefore, some Member States, like Italy, can carry on and increase favourable schemes concerning innovative startups and SMEs (Accordino, 2020).

This means that, although policymakers made up their mind on the fact that startups contribute meaningfully to the global economic panorama, they should focus on helping startup to minimize the disruption of the current business ecosystems, not only with measures that represent short-term aid but also acting in the long term, by promoting inclusive and sustainable economic models, legal frameworks and resources to support new product lines and new research also setting up or enforcing rules suitable to favour diversification and to enrich the range of the financial resources available.

Finally, our research could address their future initiatives and suggest to them adopting some of the good practices highlighted.

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Insights from the Rapid Transformation to Distance Learning Due to COVID-19: A Case of a Master of Business Administration Course[1]

Svitlana Didkivska, Viacheslav Babanin

1. Introduction

Learning, as a process, arose long ago out of the need to pass knowledge onto descendants. As a result of technological progress, methods of conducting education have changed significantly (Paliwoda-Pękosz et al., 2015). Distance learning might be perceived as an individualized process of acquiring human cognitive ability, skills, and knowledge which occurs mainly through the indirect, remote interaction between the participants of this process (interaction using different learning tools, from letters to software). This process is facilitated by educational institutions, which operate on the basis of up-to-date (at the time of use and implementation) psychological, pedagogical, information and communication technologies (Yusupova & Mulhamadieva, 2020; Golitsyna, 2017; Herasymenko, 2014). Distance learning has gained popularity due to the dynamism of changes, both political, social, and economic, and the speed of development of the information technology industry (Saba, 2016).

However, with a rapid transition to distance learning in Spring 2020 caused by the COVID-19 pandemic, all these advantages were leveled since most educational institutions were forced to modify the structure, content, and form of most courses in the middle of the educational process. This, in turn, led to a huge number of mistakes and shortcomings which made both students and teachers dissatisfied (Nenko et al., 2020; Yamamoto & Altın, 2020; Dietz, 2020). Hence, there was a need for further research in this area. The main goal of the research

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was to obtain feedback from students concerning their distance learning experience that might be useful in shaping teaching policy at universities in the future. In line with that goal, we aimed at answering the following research questions:

RQ1: What were the benefits of distance learning that might enhance an interest in this form of learning?

RQ2: What were the challenges of distance learning?

RQ3: How have students perceived the university's preparation for distance learning?

RQ4: What were students' preferences concerning forms of learning?

In order to answer the research questions, we conducted quantitative and qualitative surveys among Master of Business Administration (MBA) students of the Cracow University of Economics, Poland.

2. Research Background

Distance learning can become one of the most successful forms of learning, since it provides opportunities for adding new social interactions to the learning process (Jacobs & Ivone, 2020). The information revolution has provided new tools for organizing distance education, and the COVID-19 pandemic, unfortunately, forced universities to suddenly switch to this type of teaching, even those that did not want to do this (Hebebci, 2020). The education sector is the one most affected by the pandemic after medicine (in terms of the number of people that were influenced). The pandemic had an impact on about 1.6 billion students, i.e. about 92% of students in 195 countries (Yamamoto & Altın, 2020; Hebebci, 2020). Poor countries with high levels of social and financial inequality are still unable to cope with the situation (Dietz, 2020).

Many universities had difficulties with the introduction of distance learning, since in its modern form it is a complex system that includes aspects of an economic, technological, pedagogical and social nature (Adnan & Anwar, 2020). Therefore, a thorough study of teaching methods takes time, which universities simply did not have because of the pandemic (Manning et al., 2003; Bojović et al., 2020). Although the majority of students agreed that online education is an acceptable option for reasons of epidemiological safety, nevertheless, many of them complained about the impossibility of understanding the theoretical material at the proper level. Besides, teachers had noted the difficulty in assessing the students' knowledge through online platforms, since the systems had not yet been thoroughly tested and the current technology had not yet been properly developed to eliminate possible student dishonesty and deception during exams (Almuraqab, 2020). However, many universities have already begun to adjust to

the distance learning situation caused by the pandemic. Most of them use Zoom (https://zoom.us/), Canvas (https://learn.canvas.net), Google meet (https://meet.google.com), and other remote communication services. Some universities are more innovative in their approach to distance learning, for example, in several higher schools in the United States, during an exam, a special browser is used with the ability to block access to the external network so that students cannot cheat during exams (Chang et al., 2021).

3. Research Method

To answer the research questions, we designed two surveys. The surveys were developed according to the following rules (Dillman et al., 1998; Callegaro et al., 2015): avoiding the use of complicated words in questions and making questions simple, using appropriate wording, avoiding the use of too many open questions as this would give a lot of results that are inconsistent or useless for research, focusing questions on matters that are needed to measure and fix, and using a respondent-friendly design. The preliminary versions of the surveys were verified by several academics.

The first survey consisted of 13 questions (in the English language, as all lessons at that school were in that language) regarding the impact of the forced transition to distance learning due to COVID-19. It included both closed (including multiple-choice) and open-ended questions (see Appendix A for the list of questions). The survey was conducted using the G Suite Google Cloud package. A link to the survey was sent out in emails, in which a deadline (closing date) for the survey was clearly stated in order to set the expectations for the people when to fill it in (Dillman et al., 1998).

The second survey was of a qualitative nature and was developed to guide interviews. Its main goal was to clarify and concretize the results of the first survey (see Appendix B for the list of questions). The interviews were conducted on the Zoom platform. The entire MBA group was asked to go through the interview. One of the authors (at that time also an MBA student), after one of the classes, made appointments with those students who expressed willingness to take part in interviews (the suitable time for respondents had been arranged). Interviews were conducted in English. During the agreed meeting on Zoom, the interviewer, after gaining the consent of the respondents, made a text record of the answers into a text editor.

Both surveys were addressed to MBA course students of the Cracow University of Economics, Poland. The study involved both domestic and foreign students of three groups (Cracow School of Business Master (CSB MBA) + Master's,

International MBA, and Executive MBA). Out of the 115 students that partici-
pated in the MBA program, 43 filled in the questionnaire (in October 2020)
and seven took part in the interviews (in November 2020). Detailed informa-
tion concerning the first survey respondents' structure is presented in Table 12.1.
The interviews were attended by residents of Jordan (2), Iraq (1), United States (1),
Ukraine (1), and Poland (2).

Table 12.1. Respondents` structure in the first survey

Variable	Category	No.	%
Home country	Poland	29	67.4
	Other	14	32.6
Course	CSB MBA + Masters	11	25.6
	International MBA	20	46.5
	Executive MBA	12	27.9

Source: own work.

The courses in which respondents participated were conducted in two dis-
tance learning modes:
■ synchronized (learning is online, education happens in real time, often
with a set class schedule and required login times), and
■ asynchronized (learning does not require real-time interaction; instead,
content is available online for students to access when it best suits their
schedules, and assignments are being completed to deadlines).

4. Results

4.1. Benefits of Distance Learning (RQ1)

Table 12.2 shows that for most of the respondents, the general level of un-
derstanding of the material did not deteriorate, and the level of comfort during
classes did not suffer, according to some students it was even better.

Table 12.2. Respondents' perception of the basic aspects of learning

Correlation	Much worse than on-campus	Worse than on-campus	Same as on-campus	Better than on-campus	Much better than on-campus
Subject/materials understanding	20.9%	20.9%	55.8%	2.4%	0%
General comfort during classes	13.9%	27.9%	37.2%	13.9%	7.1%

Source: own work.

When answering an open-ended question in the first survey about the advantages of distance learning, the majority of respondents (53.5%) noted time savings, whereas 23.4% noted flexibility. Among the listed advantages, "safety" (as students stay far from potentially infected people) and comfort during classes were also often mentioned. In addition, several people noted saving money and time not coming to class (for some, these savings were significant, since they did not have to spend money on air tickets to get to the classroom). However, 13.9% of respondents were unable to find any positive aspects.

Analyzing the answers received during the interviews, students noted the following positive aspects of distance learning: savings, both time and financial, on transport and food outside home, an increased overall level of comfort, and a simplification of the note-taking process. In addition, respondents noted that in the context of a pandemic, distance learning is a necessary measure, and provides at least some opportunity for people to study.

4.2. Challenges of Distance Learning (RQ2)

Table 12.3 shows that the communication process and engagement in class activities suffered the most during distance learning (both between students and the teacher, and among students).

Table 12.3. Challenges of distance learning

Correlation	Much worse than on-campus	Worse than on-campus	Same as on-campus	Better than on-campus	Much better than on-campus
Teamwork and collaboration during class	30.2%	46.5%	18.6%	4.7%	0%
Communication with lecturer	11.6%	48.8%	34.9%	4.7%	0%
Engagement in class activities	18.6%	48.8%	30.2%	2.4%	0%

Source: own work.

In the open-ended question in the first survey concerning the challenges of remote learning, and in interviews, the respondents mentioned the following issues: difficulties in understanding and concentrating on the material, lack of engagement, difficulty in concentrating on the material, boredom, difficulties in participating in a class discussion, lack of comfort in interrupting the teacher to ask a question, difficulties in team work, missing communication with classmates outside of school, for example during recess, which prevented them from making "connections and acquaintances", lack of required equipment and technical problems. However, it should be noted that 14% of respondents in the first

survey and the two interviewed students in the second one stated that they did not face any difficulties.

4.3. University Preparation for Distance Learning (RQ3)

The perception of the level of the university's preparation for distance learning from the students' perspective is illustrated by Figure 12.1. Interestingly, almost 60% of respondents perceived it as good or very good.
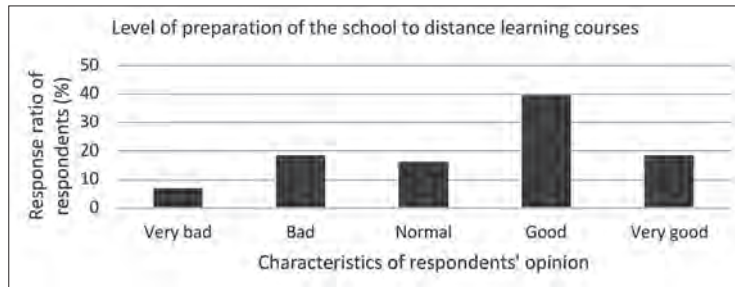

Figure 12.1. Level of preparation of the university for distance learning courses from the respondents' perspective [%]

Source: own work.

In the interviews, most respondents noted that they felt a slight decrease in the quality of educational services compared to the option of full-time education, but at the same time they realized that this was a forced measure. They admitted that the administration and teachers were making enough efforts to improve the quality of distance learning courses. In addition, considering the distance learning course as a temporary and compulsory measure, some found this experience interesting.

4.4. Students' Preferences Concerning the Form of Learning (RQ4)

Studying the issue of student satisfaction with distance learning, the general preferences of students regarding the forms of knowledge acquisition were investigated first. The majority of respondents still preferred the fully on-campus form of learning. However, almost half of them would not refuse the hybrid form of education (when both remote and on-campus options are available all the time). The vast majority of respondents (90.7%) preferred synchronized learning.

Evaluating the desire for continuing the distance learning experience, it was found that 39.5 % of respondents were satisfied with and willing to return to distance learning (they wished to continue the same distance learning course and to take a distance learning course after COVID-19 pandemic is over).

In the interviews, students noted that for them the online course was more of a forced measure, and due to the listed disadvantages of distance learning they wanted to return to stationary education as soon as possible. Besides, they believed that distance learning would have a negative effect on their mental health. Two out of seven respondents said that for them the benefits of distance learning outweighed the disadvantages, and they were interested in attending distance learning courses in the future. However, according to the students, the courses and lectures should be better prepared.

5. Discussion

The main implications of this research concern the management of the educational process at universities. The study showed that although the majority of students wanted to return to face-to-face education when faced with communication and technical difficulties, they still mentioned that the good quality of preparation of such courses might improve their attitude to this form of learning. In addition, for some of the students, the advantages (in the form of saving time and money, as well as a sense of comfort during classes) have become decisive in determining their preferences concerning the form of education (especially foreign students drew attention to these parameters). They would gladly take part in distance learning courses again after the end of the pandemic. Hence, the university should rethink educational methods and pay attention to offering various possibilities of learning to meet the expectations of a diverse student population.

6. Conclusion

The main goal of the research was to analyze students' opinions on distance learning in order to find out its positive and negative aspects and their impact on the students' desire to attend such courses in the future. Students were interviewed in the fall of 2020, when they had the opportunity to interact with an already better, improved system of distance education, thanks to which up-to-date data were obtained about the quality of such learning, its positive and negative aspects, and the attitudes towards facing this form of learning in the future. The results of the study showed that most students were satisfied with the level of preparation of the institution for distance teaching, and that in the future, after the end of the pandemic, there will be some demand for distance courses, even when face-to-face classes are possible. In future research, we would like to conduct a survey on a more diverse student population (undergraduate, graduate) in order to investigate the impact of distance learning on learning quality

and to develop the best practices for university teaching with the use of distance learning. Finding recommendations on how to adjust and maximize the value students get from a course conducted in the distance learning mode might also be an interesting path for future research.

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Appendix

A Questionnaire

1. Which MBA program do you attend? CSB MBA + Masters/International MBA/ Executive MBA
2. Are you a domestic or foreign university student? Foreign/Domestic
3. Do you experience online classes during MBA studies? Yes/No
4. What is the preferred way of conducting classes for you? Fully on-campus/Fully remote/Hybrid (both remote and on-campus options available all the time)
5. What kind of classes do you prefer? Synchronized (online education that happens in real time, often with a set class schedule and required login times)/Asynchronized (learning does not require real-time interaction; instead, content is available online for students to access when it best fits their schedules, and assignments are completed to deadlines)
6. Comparing the level of interaction during the classes, which one is better? In-Class/Online/Both are the same
7. How well prepared was the school for a fully remote way of conducting classes? Very bad/Bad/Normal/Good/Very good
8. How much has remote education impacted the quality of classes for you? scale: much worse than on-campus; worse than on-campus; same as on-campus; better than on-campus; much better than on-campus In: Subject/materials understanding/Teamwork and collaboration during class/Communication with the lecturer/General comfort during classes/Engagement in class activities
9. What main challenges are you facing in remote learning during the pandemic? (open question)
10. Would you take the same course if it was delivered online from the beginning? Yes/No
11. Would you like to participate in online courses after the COVID-19 pandemic is over? Yes/No
12. What is the biggest advantage of the remote over the on-campus way of conducting classes? (open question)
13. What is the biggest disadvantage of the remote over the on-campus way of conducting classes? (open question)

B Qualitative research

Getting started

1. How are you?
2. Can you describe yourself?
3. What are you doing in your professional life?

4. How do you find yourself in a pandemic?
5. Do you know what is remote/distance learning?
6. Are you familiar with the definitions of synchronized/asynchronized learning?
7. Do you know what hybrid teaching means?

Thematic questions

1. Do you experience online classes during MBA studies?
2. What type of classes do you prefer?
3. Can you describe or compare your level of interaction during class?
4. What do you think about online classes?
5. Do you think that the school was properly prepared for online classes?
6. Do you feel any difference between online and on-campus learning?
7. What are you missing in distance learning?
8. What is better in distance learning?
9. What is worse in distance learning?
10. What do you think about the engagement during the class? Has it changed or not?
11. How do you rate the communication with the lecturer?
12. What are your feelings about teamwork and collaboration? How does it look nowadays?
13. How would you describe your attitude towards further remote learning?

Trust as a Factor of E-Commerce Development and Building Relationship in the B2C Sector in the Situation of an Exogenous Shock[1]

Grażyna Plichta

1. Introduction

Nowadays, the development of e-commerce is to a great extent a result of the common use of modern technologies, growing mobility and the gradual growth of business digitalisation. By the end of the first quarter 2020 there was a dynamic growth of transactions concluded in virtual space. It was largely a consequence of the introduction of drastic restrictions resulting from the pandemic situation. The restrictions have brought dramatic consequences for traditional commerce, among others, but turned out to have a beneficial side effect for e-commerce. There has been a significant increase in the interest in concluding transactions on the Internet, from both buyers and firms. Firms operating on the Internet before have started to develop and improve online sales, and a lot of businesses have opened new channels for contact with customers at an accelerated rate.

In e-commerce, on each stage of contact between entities, there is risk and uncertainty. Also problems connected with building mutual relations between stakeholders become particularly apparent. The element which influences the shape of the relationship is trust. Its presence mitigates the effects of the asymmetry of information, affects the perceived risk, and indirectly also the acceptance of the conclusion of the transaction. The occurrence of a crisis evoked by negative exogenous factors (the COVID-19 pandemic, for example), as in any shock situation, causes astonishment, the growth of fear and uncertainty and influences trust level.

The paper presents a problem of the role of trust in the situation of the presence of a factor bringing about a crisis situation and its effect on the process of shaping the relationship between entities in e-commerce. It attempts to show how a threat evoked by exogenous factors affects the behaviour of e-consumers, and defines necessary actions to build mutual trust and relationship. The threat perceived by consumers resulting from the possibility of infection in, for example, brick-and-mortar stores has largely changed their purchasing behavior towards e-commerce. For consumers who had not previously shopped online, it was the moment when they had to break the barriers related to making transactions in the virtual space, because this form of transaction was often the only way to meet basic needs. While the sense of security has declined among all internet users, e-commerce is one of the industries that has benefited the most from the pandemic. Increased demand during the pandemic also means increased competition and the fight for e-consumers. Despite the huge increase in demand, companies with extensive e-commerce experience in particular offer many promotions and amenities to their customers during this period. The current situation is a big challenge for sellers, because in addition to acquiring them, the goal is to keep e-consumers for longer. To achieve this goal, various tools and methods are used on an ongoing basis to gain trust and build lasting relationships with e-consumers so that they stay with a given online store also after the pandemic.

It was assumed that a crisis situation triggered by an exogenous shock causes a change in the level of the experienced consumer trust (its drop in many cases), which influences the relationship. For sellers it means actions aiming at building trust and thus an investment in mutual market relationships. In order to present the problem in-depth the verification of the adopted assumptions was based on theoretical assumptions, available secondary data and own research findings.

2. An exogenous Shock and Socio-Economic Consequences

An exogenous shock is in practice identified from the angle of specific notions and related phenomena which occur in all significant areas of human life and in economy. According to Taleb, Krugman and Dornbusch, an exogenous shock is understood as unexpected and big changes in external factors which affect and influence internal factors (Karpavicius 2012, p. 89). The Covid-19 pandemic, which struck the world economy in 2020, is of the global character and has influenced greatly the functioning of all areas of socio-economic life. Unpredictability of the pandemic, its fast spread and the reaction of international community have definitely features of an exogenous shock (Kohlscheen et al., 2020;

McKibbin & Fernando 2021, Noy & Nualsri, 2007). Such situations of shocks on a global scale do not happen frequently and this is where their uniqueness comes from. Such a strong epidemic shock and arising consequences have caused immediate, significant and apparently permanent socio-economic effects. As a result of the introduced restrictions and increased aversion to risk, economic activity has dropped rapidly, and the area of private life has been disturbed substantially. In the past, various countries, not only European ones, were subject to external shocks, but they were usually of economic character.

The notion of a shock is known and related to economic phenomena of supranational character which evoke crisis situations. A shock, very often triggering the state of a collective social shock, can be an element of a phenomenon described as the shock doctrine (Klein, 2009). The issue of an exogenous shock is analysed in the area of many other scientific disciplines. Most often, the context of a shock appears in psychology and medicine as an individual phenomenon, in sociology as a social phenomenon. Some researchers, Schutz for example, claim that the practice of everyday life as something obvious and natural until a change is evoked, needs reflection through experiencing shock (Schutz 1972). On the other hand, according to Jaspers, the causes of shock on the individual level may be borderline situations, namely extreme experiences and feelings facing the truth, e.g. a disease (Jasper 2014). In each of the quoted cases, a situation bringing about a shock usually leads to a crisis situation on the level of individuals, entities and social structures, understood as the state of imbalance, collapse, fluctuation, disorder, etc. Therefore, the problem of a shock is of broader than simply economic nature and requires a more holistic view.

The macro-economic and neo-classical approach prevailing in economics usually discusses the problem of shocks from the angle of the effects in the form of inflation, a decline in GDP, debt, unemployment, etc., often reaching for structural or systemic causes in economy. However, it seems that the criticism towards this approach, expressed for many years, manifesting itself in the necessity to consider a greater number of factors in the description of the shock phenomenon and the search for countermeasures, is justified. In addition, what is considered important are mechanisms and processes taking place within so-called "black box". In particular, behavioural aspects are pointed to, underlying the causes of shocks and reactions to them. The example, the underlying causes for the 2008 crisis was the mechanism of moral gambling, opportunism and the faulty system of contracts on the real estate market, as well as the weakness of supervisory institutions. The state of high asymmetry of information created by the financial market institutions enabled the occurrence of the mechanism of malpractices to a large scale. According to the EBC report of April 2021, the shock related to COVID-19 was more exogenous than the crises of 2008 and 2011–2012, as the

2020 recession had its sources outside economy (in the Eurozone GDP dropped by 6.6% in comparison with 2019). The spread of COVID-19 has caused the collapse of international trade, the functioning of value chains and the growth of uncertainty on the world financial markets (EBC Report, 2021).

The behavioural aspect of this problem has been present for many years in numerous theories and concepts of the broad institutional and neo-institutional strand. Also in management studies, within the problems of attitudes, motives of behaviour and taking decisions in the conditions of risk and uncertainty, or opportunism, e.g. in the marketing approach, in the transaction costs theory, agency theory and behavioural finance.

A multi-dimensional aspect of the problem of exogenous shocks points to the need of investigating such phenomena, considering both their causes, and first of all from the point of view of their influence on the behaviours and decisions of different entities participating in market processes. The Covid-19 pandemic and the crisis triggered by it manifests itself in significant changes within individual markets. e.g. a drop in traditional trade to the benefit of e-commerce and serious obstacles in the functioning of logistics chains. In each of these areas we deal with decisions connected with restrictions for citizens who participate in the role of consumers, among others. Relations among different groups of individual entities in relationship networks with economic entities create a number of relations with specific characteristics. The occurrence of a sudden shock situation usually triggers disturbances in those relations.

As it was mentioned, the scale of the threat to human lives and the low level of knowledge about the phenomenon have caused different reactions on the institutional level in the majority of the countries of the world, including Poland. The conclusions from the EBC research suggest, among others, that the existing situation will cause higher turnover in e-commerce and a broader use of digital technologies, which will increase productivity but at the expense of a drop in employment in the long run (EBC Report 2021).

3. The Situation of the E-Commerce Industry in the Pandemic Era

In the macro scale, the pandemic has caused an "earthquake" in the world trade and the necessity to adapt to the new conditions. E-commerce is one of the industries which have benefited from the pandemic. A lot of firms realised that almost everything can be sold online and immediately transformed their activity from offline to online. The dynamic development of e-commerce is a result of the majority of firms' transformation to electronic commerce and the growth of buyers' interest in this form of shopping. At present, about 50% of consumers do

shopping on the Internet more often than before the pandemic. The introduced restrictions which have affected traditional trade, among others, and forced isolation has brought about an increase in the interest in online transactions which in a way are the only way to satisfy needs. According to report "E-commerce in the Times of the Crisis" of the Chamber of Digital Economy and Mobile Institute, 14% of Poles declared the purchase of food products and cleaning agents only via the Internet, and 24% partly via the Internet and in stationary stores. The Polish e-commerce market already before the pandemic was one of the fastest-growing ones worldwide. In 2019, as many as 62% of people using the Internet declared online shopping. According to 75% of respondents, the most important factors influencing the choice of this form of shopping is the 24-hour availability, as it guarantees independence in shopping. Also convenient delivery methods are significant (courier delivery to the indicated address, self-service parcel pick-up stations) and modern payment methods, among others BLIK, quick bank transfers, or deferred payments dates (E-commerce w Polsce 2019. Gemius dla e-Commerce Polska). According to the PMR report, the Internet commerce market in Poland in 2019 was worth over PLN 61 billion. It constituted almost 11% of the whole retail trade market, and in 2025 the share is to reach almost 20% ("Handel internetowy w Polsce 2020. Analiza i prognoza rozwoju rynku e-commerce na lata 2020–2025").

In addition to entities which did online shopping before, a large part of demand in the e-commerce sector was generated by people who, due to the restrictions introduced, did not have access to traditional trade. The growth of interest in online transactions can be in a way explained by the occurrent shock situation. In such a situation, on every market, almost always the supply side reacts to the increased demand very quickly. Reacting positively to the increased demand, the e-commerce industry tries to ensure the availability of products, the continuity of deliveries and a wide range of safe payments. Taking into consideration safety on many levels, recipients are reassured that they will receive the desired product, a safe product (e.g. packed in sterile conditions), they can choose a safe form of payment and delivery, and a possible return of the product will also be safe (E-commerce w czasie kryzysu 2020). According to the report prepared by Shopper „Handel vs koronawirus – jak sprzedaż przeniosła się do Internetu", in the first quarter 2020, online activity was commenced by from 5% to 23% more stores. They were mainly grocery stores (18%). According to the report „e-Commerce w czasie kryzysu 2020", in the face of the pandemic threat, as many as 37% of Poles found that online shopping is a safer form than the traditional one and that is why they choose it. 38% of the surveyed consumers bought food, hygiene and household chemical products for the time of quarantine online. To a great

extent, those were middle-aged people (35–44 years old). Increased demand on the Internet created problems with the availability of some goods. As many as 59% of Internet users assessed the availability of food products in e-stores as bad or very bad. Online commerce is also developing by means of social media, for example, this kind of contact is mainly used by catering which delivers its products to individual customers.

A lot indicates that the pandemic situation will strengthen the development of e-commerce in Poland and will affect a change in Poles' shopping habits („e-Commerce w czasie kryzysu 2020"). Also GlobalData experts, in their report „Wpływ Covid-19 na e-commerce" argue that the pandemic will have a long-term positive impact on the e-commerce sector. An additional support for the growth of the e-commerce market in the future are to be e-wallets as the most popular online payment method and the development of mobile and "augmented reality" – type technologies (FedEx 2021 Report Trade Trends).

4. Trust as a Factor of Building Relationships in the B2C Sector

The process of building the relationship between parties to a transaction in the virtual space requires the presence of trust. The firm usually has a substantial advantage over the customer, among others in the informative or technical aspect, therefore, the relations are largely asymmetric. Concluding transactions is always connected, among other things, with risk, therefore, the presence of trust is a method to tame it and counteract uncertainty (Sztompka 2007)[2]. It seems that no market could function properly without the presence of trust. In the transaction conclusion process it is indispensable (Grudzewski et al. 2009, p. 15) as it influences and accelerates building relationships (Rudzewicz 2018, p. 56) and it determines their quality.

Usually consumers play the role of trustees, whereas sellers become entities of trust (Grudzewski at al. 2007, p. 31). To a great extent, trust creates social capital, which affects the functioning of the economy and the economic result of society (Fukuyama 1997). It should be emphasised that no entity can be forced to put trust in anyone else. If trust occurs between specific entities, it is the effect of their free choice. The presence of trust is conditioned by benefits which can be achieved, which are accepted by both parties of the exchange and treated

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[2] In the literature of the subject there is no unambiguous definition of the term of trust. The compilation of different approaches and definitions of trust is available in papers by, among others, Sztompka (Sztompka 2007, pp. 69–70), Grudzewski at al. (Grudzewski et al. 2009, p. 16), Wierzbiński (Wierzbiński 2009, pp. 26–27), Sankowska (Sankowska 2011, pp. 31–33), Rudzewicz (Rudzewicz 2018, pp. 58–59).

"as their own". Such an approach suggests the dependence on the level of acceptance of the other party's interest and the level of trust to it (Hardin 2009, p. 26). Consumer trust is significant and it may be the effect of, among others, achieving previous positive experiences in contacts with the firm, a positive and emotional relationship with the seller, professional activity of the seller, and the consumer's attitude, which is characterised by general trust towards other entities (Sagan & Plichta 2014, p. 224). The sense of consumer trust grows when they experience a positive attitude and message from sellers, for example in the form of the extended consultancy system, the approach focused on problem solving or responsible treatment. Building consumer trust can also be favoured by: the generation of positive experiences for consumers, the presence of dedicated and personalised communication channels, or the existence of a platform with access to important information in the virtual space (Bylok 2012).

The presence of trust between entities is based on the conviction that the stronger party does not use its advantage against the weaker party, usually the consumer. Moreover, it means that the firm (the stronger party) should not conduct activities which would be inconsistent with the consumer's interest (Plichta 2013). In the case of the common use of new media and the dynamic growth of online transactions, the above statements concerning trust are particularly important[3]. They are important also because in Poland general trust has stayed on a low level for years. In the latest edition of the research of February 2020 conducted by CBOS respondents' answer to the questions: "generally, most people can be trusted" or "in relations with others one must be very careful", a lot of "carefulness" was declared by 76% of respondents, similarly to the year 2019. In the face of the pandemic, when uncertainty and fear occur, trust drops in numerous areas of socio-economic life. It is also proven by the data obtained within the research carried out within the research project[4] „Uwarunkowania i czynniki wpływające na trwałość postaw podmiotów indywidualnych w relacjach do pozostałych interesariuszy w warunkach niepewności i ryzyka wynikających z zagrożeń spowodowanych wstrząsem egzogenicznym" (No 211/20/MSAP; im-

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[3]   More on that in, among others, Plichta, G. (2020). *Role of New Media in Shaping Relationships in e-commerce on B2C Market* (in): Knowledge Economy Society. External and Internal Determinants of Modern Business Management. Jaki A. & Ziębicki B. (eds.). Wyd. TNOiK, Toruń, pp. 179–194.

[4]   The research project was carried out by a research team composed of: dr hab. Prof. UEK Jarosław Plichta (head of the research team) and Prof. dr hab. Adam Sagan and dr Grażyna Plichta (members of the research team).

plementation within REV 4.0.)[5]. Respondents' answers referring to statements concerning the opinion on the trust level between people during the pandemic are mostly negative. The lack of agreement with the statement "the pandemic time shows that people are more trustworthy" was 43.25% (only 22.49% agreed with the statement). The statement "the pandemic time shows that people trust each other more" – the lack of agreement in the case of 43.45% of respondents, 25.61% of respondents agreed with this opinion. Responses in the case of the statement "during the pandemic people will respond with greater trust, even if others are not honest towards them" were similar, namely 43.25% of respondents did not agree, and only 24.39% agreed. To an even greater extent, respondents did not agree with "the time of pandemic shows that people trust each other more than I thought before". As many as 48.44% respondents disagreed, and only 21.45% agreed with the statement, which proves the low level of trust in our society, and uncertainty or fear triggered by the crisis situation only deepens this problem.

The dynamic growth of e-commerce during the pandemic cannot obliterate the significance of undertaking actions serving the presence of trust, which has declined during the pandemic, also to the digital ecosystem. It is important that particularly in the case of physical contact, trust level plays a role in building relationship with customers. It is a challenge, among others to sellers who should do everything to prove to their customers that they deserve trust. They should deepen the relationships and make them more personal and permanent (IAB Polska „Zaufanie internautów a COVID-19". Raport z badania 2020).

A lot of influence on the positive relationship between parties in e-commerce is exerted by value creation through customer-oriented actions, e.g. personalised offers, using different facilities which are potentially beneficial to customers, as well as uniform, clear and understandable for both parties method of the communication of important contents. Nowadays, e-commerce platforms are trying to build relationship with the customer by using, among others, different facilities for customers, applying all types of novelties in the digital world, managing the user's path and responding to his needs. At present, e-commerce store

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[5]   Taking into account the limitations in access to the sampling frame and the research costs, the quota selection method was selected, which, according to many authors, is comparable to stratified random sampling. The sample size was assumed to meet the requirements for the methods based on the expected detail of cross-classification in the tabular analysis of data and sufficient to verify the assumptions made in the structural research model reflecting the research problem. The survey was conducted through a research company on a representative group of respondents (selected on the basis of current data from the Central Statistical Office of Poland) with the use of the CAWI research tool on a sample of 578 respondents. The research sample was selected according to the following criteria: age, sex, place of residence (city/village), area of residence (voivodship).

operators are investing more in technologies improving consumer experience, for example in satisfaction, comfort and quickness of doing shopping. Building relationships is significantly influenced by shortening the distance between the customer and the seller. Today, the support within that scope is provided by automatic chatbots, which help, among others, in making complaints and product returns, they follow shipments and answer questions.

It should be emphasised that a substantial role in the relationship building process is played by reliable information exchange between parties to the transaction. Moreover, an important issue is a gradual increase in the quality of service and price stability. In the pandemic situation it is extremely important, as due to different limitations on the supply side, on the sellers' side an inclination to use the crisis situation to increase prices may occur. If it is able to win consumers' trust, it usually affects the growth of the frequency of transactions, and in the long run, builds a permanent relationship.

5. Conclusions

In e-commerce the presence of the specific level of trust between entities means the investment in mutual market relationships. It results in a decrease in uncertainty in relationships, influences their durability and builds a long-term relationship. The situation of the occurrence of a rapid exogenous shock, like the pandemic, has caused disturbances in various areas of socio-economic life and influenced a change in consumer behaviours. The overall drop of the feeling of safety and uncertainty evoked by the pandemic has affected a decrease in trust, also with regard to the digital ecosystem. In spite of this, it has been found out that online transactions have intensified, which was, among others, a result of the choice of a form of shopping which would be safer from buyers' point of view, that is, not requiring physical contact. Consumers' decision about the choice of an online transaction resulted largely not from the free choice but the occurrent restrictions and a necessity to satisfy needs. At present, e-commerce is developing very well, prospects for the future are positive with a lot of likelihood that a considerable part of transactions now concluded online can be concluded in that way in the future. In spite of the current situation, firms functioning online should take actions causing customer satisfaction and "positive reception" to keep customers for longer, i.e. to build consumer trust. Gradual investment in building trust conduces not only the ability to implement the firm's set goals, but is necessary to build a mutual relationship with consumers, a long-term one if it is possible.

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The Influence of Excellence in Change Management on Organizational Resilience Moderated by Employee Awareness of Responsibility for Resilience

Anna Zabłocka-Kluczka

1. Introduction

Following the COVID-19 outbreak, research into organization's resilience is expanding rapidly. Organizational resilience is not a new subject of scientific research and incorporates insights from crisis management, contingency theories, natural accidents theory (NAT) or high reliability organizations (HRO) concept (Zabłocka-Kluczka 2020), however, it is still an underexplored phenomenon in organizational literature, characterized by the lack of clarity. The main streams of scientific research regarding organization's resilience focus on the ways in which resilience arises, on drivers of organizational resilience or their implications for organisations' functioning. This paper is not going to explain how organizational resilience emerges, but rather refers to the factors that have the ability to support or strengthen activities and actions purposefully undertaken in the hope of ensuring organizational resilience. Hamel and Välikangas (2003) suggest that organizational resilience can be understood as the capacity to change before the case for change becomes desperately obvious. Change thus seems to be imprinted in the core of an organization's resilience. From that, it is not a long way to concluding that organizations which are able to better manage change should be also more resilient. It seems also that in a specific organizational environment, when employees are aware that their organization's resilience is the consequence of their operational reliability, have a clear picture of what their role would be in a crisis and know how to respond, making changes could be easier. This issue has not yet been addressed directly in the literature on organizations' resilience. Hence, from the research gap indicated above responds to the need to verify if the mastery in managing change and employee awareness of responsibility for

resilience have together the power to influence organizations resilience. In that context, the main aim of the paper is to verify if the employee responsibility for resilience awareness is a moderator of the relation between excellence in change management and organization's resilience.

2. Literature Review and Hypotheses Development

2.1. Organization's Resilience

The first theories on organizational resilience linked it with the ability to resist the negative influences of the environment and organizational robustness. Such one-sided perception has long since been abandoned. In the context of the contemporary, dynamically changing environment, adaptability and flexibility come to the fore. However, according to Mallak (1998, p. 8) "resilience is more than a fancy word for adapting your organization to its environment". And although a widely accepted definition of organization's resilience has not yet emerged, there is general agreement that resilience is highly context-dependent, which leads to highly fragmented conceptualizations of that concept (Linnenluecke 2017). Organization's resilience is thus understood as a capacity, a property, an outcome, a process or an organization's ability to absorb or cope with disturbance or other challenging events (capacity to preserve position), but also to recognize and adapt to unexpected changes (Hamel & Välikangas 2002; Kantur & Iseri-Say, 2015; Vogus & Sutcliffe, 2007; Koronis & Ponis 2018; Lee et al. 2013; Lengnick-Hall et al. 2011; Linnenluecke 2017).

From the very beginning the focus of management theorists and practitioners is to discover how resilience is formed. That is why the drivers of organization's resilience are often the subject of multidimensional research. They vary widely across studies, however most researchers agree that the most important ones include: situation awareness, preparedness, responsiveness, resourcefulness, redundancy, robustness, rapidity, adaptability, agility, integrity, learning processes or organizational culture (Bruneau et al. 2003; Kantur & Iseri-Say, 2015; Koronis & Ponis, 2018). Another key challenge is how organizations can become resilient. This, however, in the context of perception that "each organization has their own 'perfect storm' – a combination of events or circumstances that has the potential to bring that organization to its knees" (Seville 2008, p. 3) also did not bring yet any consistent solutions. One that is widely agreed is that organizational resilience is underpinned by an organization's ability to change timely, rapidly and easily (Ates & Bititci 2011). Thus the change management process capability seems fundamental to shaping and keeping organizational resilience.

2.2. The Excellence in Change Management

Due to the importance of organizational change, change management is becoming a highly required managerial skill (By 2005; Stouten et al. 2018). There is a lack of consensus regarding basic change management principles in the scientific literature. A variety of perspectives, models and frameworks of organizational change exists (Al-Haddad & Kotnour 2015; Beer et al. 1990; Cameron & Green 2004; Stouten et al. 2018) and it is hard to judge which one is better than the others. However, regardless of the chosen framework of making changes, according to the indicated percentage of successful change processes at the level of 30% (By 2005; Al-Haddad & Kotnour 2015; Jacobs et al. 2013), the effectiveness of managing changes gains great importance.

Although the literature often refers to success in change management, the concept of success in change management is surprisingly rarely defined. In the narrow sense, it can refer to the desired result of the change management process, however in the broader context the confirmation of success in change management is "achievement goals on which the decision to introduce them was based" (Skalik 2018, p. 203). It must be underlined that achieving success in change management requires not so much the use of a specific method or framework of change management, but rather aligning those methods to the organization's needs and changing situation. In that context, excellence in change management can be understood as the proficiency (type of mastery) in continuously aligning the change policies, frameworks and methods with environmental factors so that the assumed change goals could be achieved. The term excellence is used here in a contextual meaning as something that achieves the goal or fulfills the proper functions (Konstańczak 2016), not in absolute meaning.

It is assumed that due to the enormous dynamics of changes in contemporary organizations and their environment, managing the change process requires dynamic skills, enabling creation, changes and reconfiguration of various resources into new sources of advantage competitive (Skalik 2018). According to Teece (2007, p. 1319) dynamic skills are not homogeneous and "can be disaggregated into the capacity to sense and shape opportunities and threats, to seize opportunities, and to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets". Referring this capabilities to the context of excellence in change management, fit-for-purpose, the most appropriate in a given conditions, change management first of all requires (1) sensing the need for change. Ability to detect a demand for change early enough is a precondition of establishing a sense of change, creating awareness and planning the change (creating the vision, analyzing organization, change strategy development, establishing and

communicating a change plan etc.). Planning changes however is not enough, equally important is (2) ability to seize opportunities, i.e. initiate the change processes easily, take decision and implement the changes fast enough (develop enabling structures, monitor and adjust strategies in response to problems etc.). Implementing changes also means (3) ability of effectively use the methods of overcoming resistance to change (that include also communicating the vision, empowering others to act on the vision, proper (aligned to needs) leadership etc.). Excellence in change management is the result of the managers' skill and knowledge (managers' change management competences). They shape the ability to craft the change management solutions appropriately to continuously evolving environmental factors. And the greater the alignment of these solutions, the greater the chance that the goals, on which the decision to introduce changes was based, will be met.

2.3. Organization's Resilience, Excellence in Change Management and Employee Awareness of Responsibility for Resilience – Hypotheses Development

According to King et al. (2021, p. 1) "the reciprocal nature of the relationship between the concepts of responsibilisation and resilience (…) appears almost natural". Recent literature reports strongly emphasize that stakeholder engagement is an important feature of resilient organizations (DesJardine et al. 2019; Sajko et al. 2021) and show that there is a need for shared responsibility for resilience (King et al. 2021). Although the stakeholders group it is extremely heterogeneous, it is generally possible to distinguish among them external and internal subgroups. Relationships with the external one can foster firms' capacity to absorb exogenous shocks, "because firms with broad stakeholder engagement gain access to diverse and distinctive points of view, thereby increasing the set of possible adjustments to external changes" (Sajko et al. 2021, p. 959), however, it is difficult to assign to them the responsibility for shaping the resilience of the organization. The opposite holds for internal stakeholders. The issue of social responsibility understood as different aspects of an individual's activities that endeavor to benefit the system they belong is not new. From that perspective, organizational resilience should be considered as a concerted effort by individuals and groups within organization. Soetanto & colleagues (2017) suggest that individual awareness of risks and knowledge of behavior can enhance resilience (individuals with higher perception of responsibility display increased resilient behavior, while individuals with lower perception of responsibility display a lack of resilient behavior). In that context employee awareness that the organization's resilience is the consequence of their operational reliability and is shaped not only by managerial decisions but also by their own behavior, seems to favor the

organization's resilience. Fostered by a knowledge of how to respond in crisis, both with a clear picture of employee role in a crisis and management structure, can play a critical role in reducing the shortcomings of powerful organizational actors and the same can have a positive effect on the organization's resilience. Obtaining organization's resilience requires getting support among employees for changing their practices, and this seems easier when the employee awareness of responsibility for resilience is higher. Considering all the above dependencies and accepting emerging outlook that the responsibility for resilience is not only a managers duty but also a duty of every employee and that awareness of this responsibility can enhance more resilient behavior, the following hypothesis may be formulated:

H1: There is a positive relation between Employee Awareness of Responsibility for Resilience and the Organization's Resilience.

Perhaps one of the most difficult components of effective change management is change implementation. The success of change management depends on many factors, however, the employees' willingness to work towards the change-related goals, their commitment to changes, engagement and participation in change initiatives are seen as the most important ones (Bateh et al. 2013; Brisson-Banks 2010). They can influence the level of resistance to changes which is seen as one of the main barriers and limitations to implementing change. There is a lot of reasons explaining why resistance to changes appear, from simple fear to acting deliberately to the detriment of the organization, however at the root of them often lay misunderstanding, broken agreements, trust violations or wrong quality or relationships among change participants (Bateh et al. 2013; Ford et al. 2007). Awareness and understanding, that could be a fruitful foundation for building a proactive attitude to change, seem to be thus factors enabling effective change management. According to Nicholson-Cole (2005), individual perception of own roles and responsibilities is important to change adaptation, thus employees' prior perceptions about their role and awareness of responsibilities in resilience shaping can influence their attitudes to it and their likelihood for engagement with the issue, reducing discomfort and resistance to change. Therefore, assuming employee awareness of responsibility for resilience as a factor supporting the success of the process of introducing changes in the organization, the following hypothesis may be formulated:

H2: There is a positive relation between Employee Awareness of Responsibility for Resilience and the Excellence in Change Management.

The significance of change management in creating resilient organizations is pointed in literature (Hamel & Välikangas 2002; Ates & Bititci 2011).

The change phenomenon plays a crucial role in conceptualizing resilience (Hillmann & Guenther 2021). Firstly, usually great, often sudden changes are a kind of organizational resilience tester. Secondly, to be resilient, an organisation must be able to deal with those unexpected and disruptive events, hence changes are imprinted in the ability of successful adaptation or positive functioning despite unfavourable conditions (Hamel & Välikangas 2002). It is often stressed that critical traits of a resilient organization are adaptability and flexibility (Ortiz-de-Mandojana & Bansal 2016) and an organization's resilience means not only the ability to withstand difficulties, but also the ability to transform the organization in response to environmental shifts or even to grow with challenge (Giezen et al. 2015; Hillman & Guenther 2021). This, however, requires successful management of change. 'Feeling' the demand for change (ability to anticipate or early detect the need for change) before it becomes a necessity, ability to initiate change and implement it fast enough and without undue delay, ability to overcome resistance to change supported by effective leadership seem to be factors of key importance in the difficult art of transforming organizations. The better managers can deal with the process of management change, the stronger impact it may have an on the organization's resilience. In this context the following hypothesis may be formulated:

H3: There is a positive relation between the Excellence in Change Management and the Organization's Resilience.

And finally, based on the arguments presented above, it may be stated that employee awareness of responsibility for resilience has the potential to moderate the influence of excellence of change management on the organization's resilience. According to Stouten et al. (2018) creating awareness of the need for change, justifying the reasons for it, and explaining the risks that come with its implementation or failing, is the first step to successful change management. Among other important authors indicate providing support by the change coalition (as change is a process carried out by a variety of external and internal stakeholders) and mobilizing energy for change (across multiple levels of the organization). It seems that in a specific organizational environment, where employees are aware that the organization's resilience is the consequence of their operational reliability, their own actions and decisions gaining support for understanding for change could be easier. Thus, managers, even by putting less effort into overcoming resistance to change, will be able to achieve better results, which can significantly accelerate the change process and increase the resilience of the organization. In conclusion, it can be thus assumed that when employee awareness of responsibility for resilience is higher even a small increase in the level of change management excellence can result in a greater increase in organizational resilience than

when this awareness is lower. Considering all the above, in the context of planned research scheme, the following research hypothesis was formulated:

H3M: In organizations in which the level of Employee Awareness of Responsibility for Resilience is higher, the influence of the Excellence in Change Management on the Organization's Resilience is stronger than in organizations in which the level of Employee Awareness of Responsibility for Resilience is lower. Employee Awareness of Responsibility for Resilience is thus a moderator for the relation between the Excellence in Change Management and the Organization's Resilience.

All the developed hypotheses, showing the relation between Employee Awareness of Responsibility for Resilience, Excellence in Change Management and Organization's Resilience, are presented on Figure 14.1.
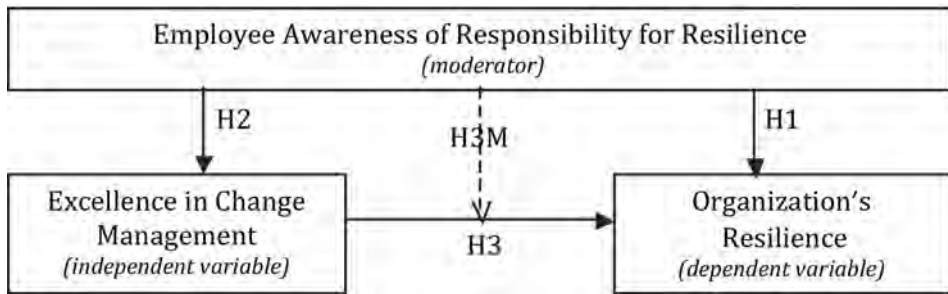

Figure 14.1. Employee awareness of responsibility for resilience as a moderator of the relation between Excellence in Change Management and Organization's Resilience

Source: own research.

3. Description of Research Methodology

3.1. Data Gathering Process and Characteristics of the Research Sample

The survey was conducted in order to verify the proposed hypotheses and identify the relations between excellence in change management and organization's resilience, and was part of a broader study on the phenomenon of organizational resilience. The research was conducted in December 2019 using an online survey service: SurveyMonkey among organizations located in Poland, which was the only condition limiting the sample. Only one survey was carried out anonymously in one organization, and it was completed by employees who have a broad view of the entire organization (senior management). 268 valid responses were collected, however due to the lack of data, the number in distinct cross-sections of the research sample (Table 14.1) is different. The sample is sufficiently diversified to be a basis for overall conclusions concerning the given topic, however it

cannot be considered as representative according to the size of the population of organizations operating in Poland. Characteristics presented in Table 14.1 show that the sample is covering organizations of all sizes and all types, although it is dominated by typically manufacturing organizations. For broader sample description see (Zabłocka-Kluczka 2020, Zabłocka-Kluczka & Sałamacha 2020).

Table 14.1. Research sample characteristics

Size of the organization	Manufacturing organizations	Service organizations	Trade organizations	Total
Micro (below 10 employees)	12	11	9	32
Small (10—49 employees)	37	15	11	63
Medium (50—249 employees)	42	26	24	92
Large (above 249 employees)	37	11	28	76
Total	128	63	72	263

Source: (Zabłocka-Kluczka 2020).

3.2. Variables Measurement

In order to examine the proposed hypotheses, key variables were defined: *Employee Awareness of Responsibility for Resilience, Excellence in Change Management* and *Organization's Resilience.*

Employee Awareness of Responsibility for Resilience (EARR) was measured by scale built from two items concerning employee's accountabilities and responsibilities for resilience and awareness of one's own role in building operational resilience. The selection of the items for the constructs was based on the literature review (Tengblad & Oudhuis (eds.) 2018; Seville 2008). They were rated on the 5-points' Likert scale (from "I strongly disagree" to "I strongly agree" with the middle point "I have no opinion").

Excellence in Change Management (*EChM*) in an organisation was measured based on a 5-point Likert scale (from "I strongly disagree" to "I strongly agree" with the middle point "I have no opinion"). There were four items on this scale, referring to the basic managerial activities that constitute the change management process (ability for early detection of change demand, ease in initiating changes, effective overcoming of resistance to changes and effectiveness in implementing changes). The questions were phrased based on the review of available literature (Skalik 2018; Teece 2007).

Variable *Organization's Resilience (ORe)* was build on the basis of four properties assigned to a system's resilience: robustness, redundancy, resourcefulness and rapidity (Bruneau et al. 2003). Within these four properties 4 measures

(respectively one item according to one property) of the organization's resilience were indicated. They were rated on the 5-points' Likert scale (from strongly disagree to strongly agree, with middle point I do not have an opinion).

4. Description od Research Results

4.1. Descriptive Statistics and Reliability Analysis of Scales

Before the hypotheses were tested, the reliability of scales of each variable was verified by computing Cronbach's α values, as a first step in the research process. The results of the analysis, both with the descriptive statistics of each variable, are presented in Table 14.2. It is worth noticing that Cronbach's α was high for *ORe* and acceptable for other variables, which indicates a high enough internal reliability of the scales and measurements, and meet the standard of reliability for survey instruments.

Table 14.2. Defined variables along with the results of the reliability analysis of scales

No.	Variable	No. of scales	Alfa-Cronbach	Factor analysis	M	SD
1	EARR	2	0.669	75.105%	3.25	0.93
2	EChM	4	0.766	60.032%	3.41	0.79
3	ORe	4	0.809	63.659%	3.29	0.87

Source: own work.

4.2. Relations between Employee Awareness of Responsibility For Resilience, Excellence in Change Management and Organization's Resilience

As the next step of the research, the correlation analysis between *EARR*, *EChM* and *ORe* was analysed to verify hypotheses H1, H2 and H3 (see Table 14.3). The results showed that the *EARR* is statistically significantly correlated with:

- *ORe* ($r(259)=0{,}625^{**}$, $p<0{,}001$), which is the basis for positive verification of hypothesis H1,
- *EChM* ($r(265)=0{,}546^{**}$, $p<0{,}001$), which is the basis for positive verification of hypothesis H2, and

In both cases correlation is positive and strong. The obtained results also showed that there is a positive, strong and statistically significant correlation between *EChM* and *ORe*. It allows for the acceptance of H3 hypothesis.

Table 14.3. Correlation analysis between analyzed variables

Variables		Excellence in Change Management	Organization's Resilience
Employee Awareness of Responsibility for Performance	r	0.546**	0.625**
	Sig.	<0.001	<0.001
	N	258	259
Excellence in Change Management	r	1	0.697**
	Sig.	–	<0.001
	N	265	258

**. Correlation is significant at a level of 0.01 (two-sided).

Source: own work.

In summary, the obtained results clearly show that there is a statistically significant, positive and strong correlation between all analyzed variables, however definitely the highest in the case of the relation between *EChM* and *ORe*. This provides support for the main hypothesis testing.

In the next, a step regression analysis was performed in which *EChM* (entered as the first) and *EARR* (entered as the second) were independent variables, while the *ORe* was a dependent variable. There is some concern that the predictors introduced into the model are correlated with each other, however, the complex model, taking into account both predictors, allows significantly better prediction of the resilience of the organization, which is indicated by a significant change in R^2 (change=0.086, $p < 0.05$). This model turned out to be a good fit for the data $F_{(2,255)}=170.924$; $p < 0.01$ and explains $R^2 = 56.9$ % of the dependent variable (*ORe*). Both predictors allow us to significantly predict the level of the dependent variable, although it is worth mentioning that *EChM* is a stronger predictor (ß=0.505; $p < 0.01$) than *EARR* (ß=0.352; $p < 0.01$).

4.3. Employee Awareness of Responsibility for Resilience as a Moderator for the Relation Between Excellence in Change Management and Organization's Resilience

The relation between excellence in change management and organization's resilience was analyzed in the context of the employee responsibility for resilience to verify whether this variable is a statistically significant moderator of the relation, which existence was verified above. Regression analysis with moderator was used to determine that. As a first step, a new variable – moderator – was introduced. The moderator variable was built as a product of two standardized independent variables (*EChM* and *EARR* as a second independent variable). As a second step, 3 regression models were built and tested (the analysis was per-

formed using Process macro for IBM SPSS Statistics). The results of the analysis are presented in Table 14.4.

Table 14.4. Regression models' statistics

Model description	R^2	Delta R^2	Moderator coeff.	Standard error	t Stat	P Value
Employee Awareness of Responsibility for Resilience, Excellence in Change Management, Moderator dependent v.: Organization's Resilience	0.580	0.007	0.075	0.036	2.070	0.0395

Source: own work.

In the model, the influence of *EChM* on *ORe* as dependent variable is significant (t = 2.71, p = 0.0073). The relationship between the moderating variable (*EARR*) and the dependent variable (*ORe*) appeared to be insignificant (t = 0.49, p = 0.622). However, the interaction effect of *EchM* and *EARR* for the dependent variable (*ORe*) is significant (t = 2.07, p = 0,0395). The obtained model clearly shows that the responsibility for resilience is a moderator of analyzed relations. The delta R2 and the obtained model are statistically significant (F (1, 268) = 4,283, p < 0,05). Therefore, the results are the basis for a positive verification of hypotheses H3M confirming that *Employee Awareness of Responsibility for Resilience* is a moderator for the relation between the *Excellence in Change Management* and *the Organization's Resilience.*

5. Discussion

Acquiring resilience doe not occur by accident, but is a gradual process of organization "learning", even from small everyday matters, not only the most severe ones. The expected effect of the organizational learning processes is not only the increase in knowledge, but above all changes in the methods of acting, market behavior or cooperation with the environment. In this context, the importance of change management process capability is not surprising and the mastery in sensing the need for change, as well as proficiency in continuously aligning the change policies, frameworks and methods with the environmental factors so that the assumed change goals could be achieved, takes on a key importance.

Literature suggests that "resilience is a learnable capacity which can be (…) developed within employees" (Linnenluecke 2017, p. 18). This suggests that resilience is not only a managers' duty, but is created by relations with others members of the organization. The conducted research showed that employee awareness of

responsibility for resilience is a valuable enabler which needs to be worked upon to ensure resilience. There is of course a difference between awareness and involvement (action), however awareness seems to be a precondition of the capacity of response. Awareness generates the ability not only to sense the current situation, but also to project it forward in time and to understand its implications. The fact that employees are aware of their own responsibility in critical situations, know the role of each organization's member in line with the organization's crisis management plan, does not necessarily mean that they will behave in the previously foreseen way. Crises that test the resilience of an organization rarely follow a well-defined pattern and in some cases it will even be necessary to act contravening the usual solutions and procedures. Being aware of the situation and available solutions may allow employees to change routine behavior without waiting for a manager's command, which can save valuable time or even become a critical success factor in shaping the resilience of the organization. Sensing when and how to act is not only a manager's privilege and awareness of responsibility for resilience produces an active employee, who however, according to Welsh (2014), acts to maintain the status quo rather than conceive of challenging it.

Resilience is perceived as "something requiring broad contribution from volunteer innovators contributing their diverse perspectives to the quest rather than relying on a CEO's privileged viewpoint alone" (Välikangas 2010, p. 131). The conducted research stresses the importance of sharing responsibility for resilience. It must be underlined that responsibility should be understood here as *being responsive*, which "implies the ability to identify and respond appropriately and carefully to the needs (…) instead of being an ex-post justification for results and consequences for what has been done, or not done" (Küpers 2011, p. 139). So understood responsibility opens the broader point of view and sets new patterns of behavior and possibility of evolving organizational standards favoring organizational resilience. And finally, it was also confirm that coexistence of employees awareness of responsibility for resilience and excellence of change management favors organization's resilience.

6. Conclusion

Looking for factors building and strengthening an organization's resilience has been of interest to researchers for a long time. This paper explores only a part of the issues related to the studied phenomenon. The main focus of the study was to verify if there is relationship between excellence of change management (perceived in the context of managers' mastery in managing changes) and organization's resilience, and if so, can this link be strengthened by other factors (e.g. by employee responsibility

for resilience awareness). The subject of research was not the ability of use some specific method of managing change or ability of managing the changes itself, but rather the ability to do it in alignment of environmental and organizational requirements in the best possible way. For this purpose, a variable *Excellence in Change Management* was built on the predictors based on Teece's (2007) dynamic skills. The results of the presented study confirmed adopted assumptions and in that way contribute to the very fragmented theory of organizational resilience. The paper also has practical implications. It shows the importance of investing time in the earlier stages of the change management process in shaping awareness of responsibility for resilience and awareness of the need for change, in order to prepare individuals and so embed change more quickly and effectively.

However, the performed empirical study is burdened with certain limitations. The obtained sample of 268 organizations is by far not a representative sample and verified only in one business context. Moreover, one could discuss the need to introduce indirect (intermediary) variables, because it is debatable whether the studied variables are not too "distant" from "organizational resilience", although they certainly influence it, and whether they are not correlated with other factors influencing organizational resilience. The obtained results seem to constitute only a small step in the analysis of factors shaping the organization's resilience, and there is a strong need for further research and in-depth analysis, especially exploring simultaneously more than only one organizational factor influencing resilience. The above insights open up new research perspectives that could provide interesting hints for organizational resilience management.

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The Importance of Human Capital as a Key Competitiveness Factor in the Tourism Sector

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1. Introduction

Effective management of a tourism enterprise covers many various activities aimed at effective achievement of the intended objectives, with the use of all resources of the enterprise. An important factor in functioning of the enterprise is proper management of human capital, especially in the tourism sector providing services of non-material nature. The changes taking place nowadays have led to a remodelling of the structure of the existing tourist market. This situation makes it necessary to analyse factors ensuring competitiveness of enterprises. The main objective of the article is to identify key factors of fundamental importance in building human capital. These factors represent treasured values enabling the development of those components that differentiate between segments of the tourism sector. These elements lead to a competitive advantage in this area.

2. The Concept of Human Capital

Making an attempt to define the concept of human capital, it can be stated that the overview of interpretations of this concept is very diverse. It is worth noting that the multiplicity and diversity of desiderations in this field complicates the creation of an unambiguous definition and at the same time allows revealing the complex structure of this issue. The most common view is that human capital is identified with formal education and skills acquired in the process of education that can be used in everyday professional work (Kożuch, 2000, p. 56). Grodzicki points out that "human capital" can be considered as the knowledge, skills of a person having economic value for the organisation (Grodzicki, 2003, p. 42). In turn, Begg defines human capital as "knowledge and skills embodied in people". (Begg, 1992, p. 334). In the context of the above mentioned defini-

tions, the term means the stock of useful knowledge accumulated in the process of education and includes inborn skills, personality predispositions and those conditioned by the family environment. In the structure of human capital, there also appears the dimension of personality traits, as well as attitudes and motivations. The list should be expanded to include adaptability, the ability to share knowledge and trust, the system of values and norms, interpersonal relations, action styles, innovation, entrepreneurship and commitment. In this way, we can distinguish between innate human capital (talents, skills and abilities) and acquired human capital (through education and experience). Human capital represents manufactured values with a specific structure and includes intellectual, social and emotional capital (Wyrzykowska, 2013, p. 256). These components are mutually supportive, closely related and interact with each other to form the foundations of entrepreneurial activities. The integration of the above components of human capital can be a determinant and a guarantor of the growth of a company's competitiveness.

3. Human Capital and Competitiveness in the Tourism Sector

The development of the tourism sector is influenced by various factors and processes occurring at various levels of social life. The current social and economic situation, and thus the growing need to adapt the tourism sector to new paradigms in terms of implementing appropriate development policies for this segment of the economy, makes it necessary to consider human capital as one of the key factors in the development of competitive strategies. In this respect, it is necessary to analyse the changes taking place in the economic activity in tourism and the components that enable this sector to have a new perspective in the new reality.

The tourism sector includes entities for which tourism is the main activity, as well as those indirectly related to it. Throughout history, tourism has been an integral part of the functioning and development of humanity. "Tourism is a phenomenon that can be considered in psychological, social, economic, spatial-cultural and, above all, political aspects". (Bohdanowicz, 2005, p. 83). Nowadays, tourism is a response to the expectations of the rapidly growing tourist community. Tourism is becoming one of the fastest growing fields of social life and is an important source of income in the economy, as well as influencing the life of an individual and the functioning of the whole society. Tourism is a multi-faceted phenomenon, encompassing psychological, social, cultural and economic aspects of human beings.

It is important to note the paradigm shifts in modern tourism. These changes include constantly developing new information technologies, new forms

of production, and also result from the development of other fields, in changing environmental conditions. Factors also arise from contemporary crises and include aspects of generational change in recreational behaviour that directly affect development of tourism.

Knowles and Curtis (Knowles & Curtis 1999, pp. 87–96) analysed the post-stage mass tourism destination and pointed out its negative effects. These are expressed in the excessive development of tourism oriented towards unlimited exploitation of environmental resources and uncontrolled economic price policy. The authors draw attention to the long-term perspective taking into account new trends in the tourism sector concerning sophisticated demand, sublime quality of services, as well as increasingly demanding consumers looking for adaptation of the tourist offer to their needs. Buhalis (Buhalis 2000, pp. 97–116), on the other hand, believes that there are factors that enable the internal contradictions created by low-cost tourism market strategies. Therefore, the appropriate economic level of participants in the implementation of tourism activities is to guarantee the profitability of this sector, while maintaining and guaranteeing a minimum level of quality of tourism services.

In such a situation, an increasingly heterogeneous demand and thus an increasingly diverse tourist market segment can be observed. The consequence of this is differentiated individual interest in the quality of services provided. At the same time, changes are taking place in the style and touristic qualities of consumers related to their economic status when selecting an appropriate tourist product. This product is increasingly affordable for them and aimed at differentiated segments of the tourism product, which are treated as luxury goods.

For this reason, the most noticeable economic effects are associated with organised mass tourism. This type of tourism is becoming a factor of socio--economic change. For this reason, it should focus on the flexibility of the services offered, achieving competitive product prices combined with an adequate level of quality, thus increasing its ability to meet increasingly complex tourist demand.

These aspects give rise to the need to pay attention to the tourism sector development strategy, which allows for the creation of its brand. The brand includes a set of perceptions, feelings and beliefs that a tourist associates with a given area and the tourist product it offers, consistent with quantitative and qualitative expectations (Filar, Rzońca & Wójtowicz, 2007). A properly developed sector strategy becomes an attractive tourist destination, often an alternative to the existing one.

Tourism development strategy results from the needs of effective management of a given area and is based on proper functioning of the local tourism market, including the sphere of entrepreneurs and local community. This strategy becomes an indispensable instrument for increasing competitiveness (Rochmińska

& Stasiak, 2004, p. 9–43). There is an inherent problem of sustainability of tourism in the sphere of economic security, nevertheless, the issue of social interaction seems to be fundamental in shaping the tourism sector system.

It should be stated that the contemporary perspective opening to the tourism sector in the new reality is oriented towards specialised tourism products, functioning within the adopted market strategy module, thanks to the adopted qualitative management parameters.

4. Competitiveness and the Tourism Sector

Stankiewicz defines competition as "a phenomenon whose participants compete with each other in pursuit of analogous goals, which means that actions taken by some to achieve certain goals make it difficult (or even impossible) for others to achieve the same goals" (Stankiewicz, 2002, p. 18.). What is important in this regard is that the phenomenon of competition is recognised as an essential element of economic life. This phenomenon manifests itself through both positive and negative features. The former relate to the effective use of the enterprise's resources (increase in innovation and development of the specificity of the organisation), while the negative factors are associated with unfair competition, monopolisation of sectoral activities or excessive concentration of factors affecting the development of a given sector.

In relation to the issue in question, it is worth looking at Porter's competitiveness model (Porter, 1992, p. 22), which indicates the elements that, in terms of building a tourism segment, enable the adoption of the right perspective for the development of a given sector. Competitiveness can be understood as "adjusting the product to the requirements of the market and competition, especially in terms of assortment, quality, price, as well as using optimal sales channels and promotion methods" (Bosak, 2008, p. 612), which leads to the construction of appropriate product quality.

The essence of competitiveness is to stimulate the level of human aspiration to achieve the best results and includes material and non-material levels of well-being. This process is a universal phenomenon and refers to the area of economic and social life, and can be seen as the achievement of intended objectives in the global, international, national, regional or local sphere. Currently, competition can be treated as an opportunity for cooperation between business partners in the sphere of products (tourist services) or resources (human capital).

Due to the fact that the tourism sector operates in a specific environment which determines its competitiveness, Mazur-Wierzbicka (Mazur-Wierzbicka, 2007, p. 31) points to factors which influence this situation, e.g. the level of inno-

vativeness and technological advancement of the enterprise, network of partners and contractors, ways and forms of financing the enterprise, own investments of the company, availability of capital, staff and enterprise culture among employees. It is worth paying attention to the model of competitiveness potential proposed by Stankiewicz (Stankiewicz, 1999, p. 39). This model should be understood as a system of tangible and intangible resources that allow building competitive advantage.

It is worth noting that the competitiveness analysis of the tourism sector identifies those categories that are reflected in human resources, as well as material resources, knowledge, capital and historical and cultural factors. In this case, tourism plays the role of a factor stimulating the development of a given area. In relation to tourist destinations, it seems important to pay attention to the issue of comparative destinations, which in this sector result from the characteristics of the destination itself within the natural resources and factors configuring the destination (Crouch, 2011, p. 27–45). The concept of competitiveness has evolved over the years from a traditional approach to one based on comparative advantage. In the case of the tourism sector, the determinants of its competitiveness are located in comparative advantages, which are related to the strategic equipment of the tourist destination. The strategic importance in this regard refers to those elements that are based on the use of human capital. Consequently, competitiveness will depend on the integration and combination of factors such as the competitive capacity of enterprises, the provision of infrastructure, the availability of human capital and the macroeconomic and institutional environment.

5. Competitiveness Factors in Tourism

Competitiveness is the basic condition for development of any enterprise. Gaining a relatively permanent competitive advantage over other entities makes it possible to achieve the intended objective of the enterprise through the dynamically developing tourist market.

Consequently, such features of the tourism sector as: seasonality of demand for the offered products, relatively permanent production potential of the products, their immateriality, as well as the necessity of immediate provision with its multifaceted complexity and diversity make the scope of issues concerning competitiveness of entities operating in the tourism market sector exceptionally important and up-to-date.

The literature accepts two basic approaches to the phenomenon of competition: structural (static) and behavioural (dynamic) (Vickers, 1994, p. 226). The former indicates a specific process occurring in a specific reality, while the

latter locates this phenomenon in a segment containing elements of competition between companies.

Sziva (Sziva, 2010), on the basis of the literature, selected the most frequent factors in this area and distinguished primary and supporting resources, as well as indirectly influencing and complementary resources, affecting product development. On the other hand, Ritchie and Crouch in their study detailed the factors of competitiveness, in which they distinguished human and physical resources, tourism infrastructure, historical and cultural resources. A similar division was made by Dwyer and Kim (Dwyer & Kim, 2003, pp. 369–414), who pointed to available resources (natural, cultural, heritage resources), created resources (tourism services and infrastructure) and supporting factors (general infrastructure, quality of services, destination accessibility).

The approach to competitiveness factors is based on Porter's concept and is reflected in the studies of the World Economic Forum (WEF) and the International Institute for Management Development (IMD). The above issues in the field of tourism are dealt with by the Travel & Tourism Competitiveness Index (TTCI), under which the Travel & Tourism Competitiveness Report is prepared. Based on Gooroochum and Sugiyarto (Gooroochurn & Sugiyarto, 2005), they distinguished the following eight indicators of competitiveness in tourism: price competitiveness index, human factors, infrastructure development, environmental index, technological development index, as well as human resources index, opening index and social development index.

6. Porter's Competitiveness Model – Application to the Tourism Sector

The factors for achieving long-term and sustainable competitive advantage in the tourism sector can be justified by Porter's five forces model. This model takes into account the factors to be adopted when studying the sector (threat of new entrants, threat of substitutes, bargaining power of suppliers, bargaining power of buyers and rivalry between organisations in the sector) (Porter, 1980, p. 4). It indicates that the attractiveness of a sector is the greater the lower e.g. the intensity of competition between companies in a given sector, the lower the threat of entry of new companies, or the attractiveness of products and services. Within the framework of the adopted competitiveness strategy, it is worth paying special attention to factors that consider human capital as an investment (intangible) in human development, knowledge, education and training, which is in fact a complex issue. In this aspect, it should be assumed that the above model seems to be one of the main tools in the case of strategic analysis of competitiveness of tourist destinations. This model includes all the factors that, by co-existing with

each other, determine the possible competitive advantage of tourism activities. It should be emphasized that more important than the analysis of each of the above elements of the Portrea model is the analysis of the interrelationships between all the factors.

Intangible resources of an organisation are the main focus of many contemporary theories describing complex internal and external processes occurring in an organisation. The concept of intangible resources of an organisation is based on defining a company as a conglomerate of resources and abilities and intangible assets as the basic sources of permanent competitive advantage.

Due to the characteristics possessed by intangible resources (realised by people, simultaneous multiple use, long-term accumulation), during their use they behave differently from material resources (Głuszek, 2004, p. 26–27). As indicated above, resources can be tangible, such as objects, financial assets, or intangible, such as employee qualifications, reputation, brand image. In this sense, Amint and Schoemaker (Amit & Schoemaker, 1993, pp. 33–46) consider that resources can be transformed into final products or services using a wide range of interrelated mechanisms (technology, management information systems, motivational strategy, trust between management and employees) related to the assets owned. However, it seems that the resources mentioned and analysed, by themselves, do not sufficiently justify competitive advantage. Therefore, it is considered that the capability potential of a company is a dynamic concept that externalizes when all the broadly understood resources of a company are combined with organizational patterns. In this way, the company's strategy will not only make use of existing resources, but as a result of permanent analysis will also reveal new, often innovative, and thus necessary factors for its development.

7. Human Capital and Competitive Advantage in Tourism

Determining which competitive strategies should be pursued in the tourism sector becomes increasingly important when analysing intangible assets. Bearing in mind that human capital is becoming the main cause of competitive advantage due to the fact that tangible (measurable) goods make it possible to standardise them and thus make them comparable. People, on the other hand, constitute an unmeasurable and intangible resource of the organization's factors, which are created after their existence (Rokita, 2005, p. 139). Understanding the essence of creating competitive advantage indicates the need to clarify the notion of competence and skills, which are used interchangeably in everyday language. The former are understood as routinized activities that enable a constant increase in the effectiveness of activities using the multifunctional organizational

potential of the organization (Rybak, 2003, pp. 14–15). Competencies, on the other hand, are understood as the result of possessing a wide variety of skills for different activities and processes. They represent a unique and unrepeatable form of organisational skills specific only to a particular enterprise. These core competencies should be understood as specific skills and orientations aimed at achieving the highest possible level of consumer satisfaction.

Intangible assets, which include knowledge, information, involvement and creativity, and flexibility, can lead to dynamic and innovative development of an organisation, thanks to which it becomes competitive. It is worth noting that the described intangible resources of the organisation take into account its intellectual capital, which consists of the competences of employees, the general internal structure and the system of external relations (Mikuła, Pietruszka-Ortyl & Potocki, 2002, p. 37–39). These components as assets of the organisation's resources can be treated as human capital, which is the basis of intellectual capital.

It should be noted that in a service sector such as a tourism enterprise, the primary productive resource is the employed people who produce it. Consequently, competitive advantage is closely linked to human resource capacity. This reality is particularly evident in the tourism sector, where the importance and role of human resources underpins its activities.

In fact, the human element is a unique and extremely important factor for the operation of businesses in the tourism services sector because, unlike the manufacturing sector, services are inextricably linked to the employees who provide them and are an essential link in the value chain perceived by the customer wishing to obtain a sufficiently high level of service quality. It can therefore be seen how important the professionalisation of employees is for the functioning of the tourism sector, since most of them interact directly with the customer. Thanks to beneficial building of relations between the employee and the customer (tourist), the latter forms his/her opinion on the level of service provision and meeting his/her expectations. It should be emphasised that the functioning of the tourism segment depends on the customer, who is a participant in the production process, acquiring a specific tourism experience as a result of this process, who decides to use another service in this area again.

Human resources in the tourism activity segment are closely and inseparably connected with quality parameters perceived by the tourist (consumer). Therefore, it can be concluded that the basic element for obtaining high quality parameters of tourism services is the link with the quality of human capital, which is a key element of competitiveness.

8. The Key Role of Tourism Education

All the elements that influence the construction of a tourist experience, and thus determine the level of satisfaction, are directly related to the work performed by professionals employed in the tourism sector, in which the human factor plays a key role.

It seems that investing in new technologies or fully-equipped state-of-the-art facilities, while at the same time lacking specialised and motivated staff, cannot provide an adequate level of services that meets customers' expectations. Since competitiveness in the tourism sector is related to the quality of human capital, i.e. basic competences related to knowledge, attitudes and skills of interpersonal interaction, it is undoubtedly related to high quality of education in this field.

Undoubtedly, investment in the development of the education system in the broadly understood human capital in tourism should be treated as a strategic investment for the needs of the tourism sector. The existence of specialised education for the tourism sector becomes a key element of business success in this field. On the other hand, in the case of the reverse situation involving education insufficient and inadequate to the needs of the tourism market, lack of a uniform concept of educational activities, as well as failure to adapt educational activities to the changes taking place in the tourism sector may contribute to lower competitiveness of this sector.

The need to create an appropriate education system in that field becomes a key element of functioning of that sector at a level commensurate with that of the whole economic system, therefore it requires cooperation of all parties responsible for proper development of the tourist sector.

9. Conclusion

The starting point of this study was an analysis aimed at indicating whether human capital can be considered a strategic factor for competitiveness in the tourism sector. A characteristic feature of the tourism sector is its intangible human capital assets, in which sources of competitiveness must be identified. It therefore appears that human capital in tourism and education in particular, is one of the important and key factors for achieving a sustainable competitive advantage for the sector. Human capital in tourism undoubtedly plays a very important role. The implementation of high-quality education aimed at developing the values applicable in the tourism sector is of strategic importance for the development of the tourism sector in terms of the development of human capital.

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Assessing the Personalization of Higher Education: Maturity Framework Development

Mariia Rizun

1. Introduction

In recent years, higher education all over the world has undergone many changes. The Bologna Treaty, new teaching paradigms, the new perspective of the student as a "customer", the opening of universities to enterprises, the competition of institutions – all of these forced higher education institutions to adopt agile management methodologies in order to be capable of adapting to the constant environment changes (Carvalho, Pereira, & Rocha, 2018).

Many research works dedicated to HEI's management processes are focused on applying Information Technology at educational institutions since education today is hardly possible without using technologies to a certain extent. For this reason, it is widely considered that information system (IS) management in HEIs should be carried out with the help that maturity models (MMs) or frameworks[1] can provide (Carvalho, Pereira, & Rocha, 2019). Recent extended literature reviews found in primary research databases show that over a hundred different maturity frameworks (MFs) for managing IS have been proposed so far. However, the implementation of MFs for educational institutions has already grown beyond the IS management. Such frameworks are applied to evaluate academic courses, students' social and career maturity, e-learning improvement, and many other aspects of higher education.

In the paper realization of three objectives is presented:

O1: Conduct the literature review on maturity frameworks developed for analysis and improvement of processes running at HEIs.

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[1] In the paper the maturity framework is considered as a set of assumptions and/or methods used to build a maturity model. Maturity model is a schematic, visual form of a framework suggested to improve maturity of a certain unit.

O2: Discover the research works dedicated to developing maturity frameworks for the personalization of education and reveal the gap (if any) in this research area.

O3: Develop the author's version of a maturity framework for assessment of higher education personalization.

The paper is further organized as follows. In section 2, the notion of personalization of higher education is explained. Section 3 contains a literature review of maturity models and frameworks developed for HEIs. In section 4, the author presents the key elements of the suggested maturity framework for education personalization assessment. Finally, section 5 is dedicated to a discussion of the research contribution, further research, and conclusions.

2. Personalization of Education at Higher Education Institutions

In the past centuries, together with the transformation of education, the personality of a student of a HEI has undergone significant changes. Students are no longer only young people aged 18–21 (when they begin their education); their interests, apart from education, are much more varied, and their ambitions are much higher; they are much more conscious and selective when choosing a HEI (Orîndaru, 2015), (Ramsden, 2008), (Quaye & Harper, 2014), (Navarro, Iglesias, & Torres, 2005). Therefore, managing the decision-making process of potential and actual students is practically essential for any HEI (Moogan, 2011).

The author's suggestion is to apply the notion "Student's Individual Higher Education Profile" when talking about the decisions made by students in the process of education. Study programs, courses (elective and obligatory), languages, internships, exchange programs, research topics, tutors and supervisors, extra-curricular activities, schedule, etc. – all the issues important within the study process and selected by a student, form a set with characteristics that describe a student as a participant of this process. The Individual Profile is formed by a student's decisions and choices. Yet, the possibility of making these choices is provided to students by their educational institutions.

The approach of HEIs towards the preferences and needs of students has received different names from the group of researchers and HEIs authorities. To investigate this phenomenon with no ambiguity, the author has conducted an extended literature review. The review demonstrated that many of the works connected with HEIs consider the development of individual curricula for e-learning and mobile learning, or some specific areas of education like music, art, or medicine. This allows assuming that the personalized approach of HEIs towards students' preferences as for their education path is quite well analyzed in

the literature and is also a question of concern for HEIs. Yet, the concept of personalization of education, in a way the author sees it, is not covered extensively enough.

It was revealed that the word "individualization" (and "individual", "individualize", "individualized") is mainly applied (in connection with education) to describe an individual approach to students with disabilities (Individualized Education Program – IEP) or patients with severe conditions. Although in some research works individualization is still considered as the individual approach towards education of students in accordance with their capabilities, it is hardly possible to ignore the topic of IEP met in every other research paper. That is why the author chose not to use the term "individualization" and its derivatives to describe the approach of HEIs towards students' choices in education. Nevertheless, the concept of a student's Individual Higher Education Profile remains to be understood as a set of students' professional interests and their choices of courses, study programs, and extracurricular activities at a particular HEI.

The term "personalization" derived from "personality" is formally described as "a set of behaviors, cognitions, and emotional patterns". The review with the keywords "personalization" and "personalized" did not give any ambiguous results. Therefore, the author found the term to be suitable for further research: Individual Higher Education Profile of a student at a HEI is (supposed to be) formed in the process of *personalization of education* at this particular HEI.

3. Maturity Models for Higher Education – Literature Review

The literature review was conducted to determine what MMs/MFs for HEIs have been developed in the past ten years. The review was conducted following the PRISMA guidelines and the rules of Systematic Literature Review. A set of selection criteria, divided into two groups, was applied (Meyer & Claes, 2018):

1. Inclusion criteria – a paper that meets all the criteria is supposed to be relevant for the review: 1) The primary subject of study has to be a HEI (or a few); 2) The main object of the study has to be the maturity of a process (or a few) performed at a HEI; 3) The study has to be dedicated to the development and/or analysis of an MM/MF for a HEI (or its department).
2. Exclusion criteria – a paper that satisfies such a criterion is not suitable for further review: 1) Studies that focus on students' emotional, religious, cultural, moral, career/vocational skills, or social maturity; 2) Studies that focus on students learning about maturity (e.g., personal maturity, climate maturity, etc.); 3) Studies that focus on students' maturity exams.

From the three digital research databases (ScienceDirect, Scopus, and Web of Science), 511 papers were obtained. Then the results were compared, and the duplicates were excluded – resulting in the reduction of the number of papers to 356. Only 57 papers could be accessed. After the criteria were applied, 23 papers were selected to be included in a qualitative synthesis. Additionally, from an analysis of the references, 18 papers were included in the qualitative synthesis. Table 16.1 contains the list of the revealed MMs developed (or significantly improved) in the last decade and dedicated to the processes running at HEIs.

Table 16.1. Education maturity models: results of literature review

Author(s)	Maturity model/framework
(Nsamba, 2019)	Maturity Assessment Framework for Open Distance E-Learning (MAFODeL)
(Marshall & Mitchell, 2004); (Marshall, 2010)	E-Learning Maturity Model (eMM)
(Peñafiel et al., 2017)	Contribution to the eMM with the inclusion of a new Key Process Area – Accessibility
(Hong & Xinyi, 2019)	E-learning Process Capability Maturity Model (EPCMM)
(Durek, Kadoic, & Begicevic Redep, 2018)	Digital Maturity Framework for HEIs (DMFHEI)
(Aliyu et al., 2020)	Holistic Cybersecurity Maturity Assessment Framework (HCYMAF)
(Thong, Yusmadi, Rusli, & Nor Hayati, 2012a), (Thong, Yusmadi, Rusli, & Nor Hayati, 2012b)	Curriculum Design Maturity Model (CDMM)
(Reçi & Bollin, 2017), (Reçi & Bollin, 2019), (Reci & Bollin, 2019)	Teaching Maturity Model (TeaM)
(Enke, Glass, & Metternich, 2017); (Enke, Metternich, Bentz, & Klaes, 2018)	Maturity Model for Learning Factories
(Carvalho et al., 2019)	HEI Maturity Model (HEIMM)
(Secundo, Elena-Perez, Martinaitis, & Leitner, 2015)flexible and comprehensive "IC Maturity Model" for Universities (ICMM	Intellectual Capital Maturity Model (ICMM) for HEIs
(Matkovic, Pavlicevic, & Tumbas, 2017)	Business Process Modeling Maturity and Adoption Model for HEIs
(Boughzala & de Vreede, 2015)	Collaboration Maturity Model (Col-MM)

Source: own study.

The literature review has revealed many works dedicated to MMs aimed at improving various processes running at HEIs. Some of the models appear to be brand new, while some are modifications of the models developed earlier. The review leads us to the realization of the first objective (O1) set in the paper. At the same time, the review has allowed making a much more important discovery – that no MM or MF has so far been dedicated to the issues of personalization of students' education. This leads to the realization of the second objective (O2) – it can be seen that there is currently a gap that can be filled by suggesting a matu-

rity framework for the development and improvement of education personalization processes at HEIs.

4. Maturity Framework for Assessment of Higher Education Personalization

This section is dedicated to the education personalization maturity framework (hereinafter also – the Framework) developed by the author. Therefore, the third objective (O3) of the paper is realized here.

4.1 Design Decisions in The Education Personalization Maturity Framework Development

Some researchers have come up with the conclusion that for most MMs found in literature, the dominant development approach is the Design Science Research (Carvalho et al., 2019), with the two iterative steps considered: design of a model, and evaluation of the model's utility (March & Smith, 1995). In 2011, (Mettler, 2011) suggested a framework of maturity model design process which consists of five iterative steps. The five steps of design activities by Mettler are as follows: identify need or new opportunity, define scope, design model, evaluate design, and reflect evolution. This methodology was used by the author when making decisions as for the Framework.

At the "Identify need or new opportunity" stage, the author sees the Framework as the "emerging" and "new" one, because, as the literature review has shown, no maturity model/framework for personalization of higher education has been developed so far. The "Define scope" decisions are supposed to set the outer boundaries for the Framework application and use (de Bruin, Rosemann, Freeze, & Kulkarni, 2005). The author's choices are: "specific issue" (applied only for HEIs), "inter-organizational" (covers internal processes of HEIs and their cooperation with other organizations), and "both" the Management- and Technology--oriented staff of HEIs. In the "Design model" activity, the Framework is characterized as follows: a "process-oriented" and "multi-dimensional" (focused on several objectives) framework, where the design process is a "combination" of theory (e.g., literature review) and practice (the experts' knowledge). The design product of the Framework is a "combination" of textual description and software instantiation. The Framework is supposed to be implemented by HEI's with no third parties engaged, so the application method is "self-assessment". Finally, the "combination" of management, staff, and business partners, as respondents of the Framework, was selected. The subject of evaluation in the "Evaluate design" stage is "design product". The evaluation and verification of the Framework are to be

conducted before it is implemented, so the option of "ex-ante" evaluation is selected. Additionally, the evaluation is to be performed with the "naturalistic" method, i.e., it should be based on the experience and reflection of real users (Carvalho et al., 2019). In the "Reflect evolution" activity, the author has selected "continuous" evolution. The author also believes that the modifications in the Framework can be implemented by its users, which leads to the "external/open" structure of change.

4.2. Structure of the Education Personalization Maturity Framework

The research team (Nelson, Clarke, & Stoodley, 2014) defines the following components of any MM/MF: content, indicators of maturity status, and quality of the content. The content of a MM/MF is made of a practices-processes--categories combination. Practices are associated with policies and activities of an educational institution on a specific issue, being the focus when verifying process maturity. Practices of a similar kind can be united into processes, which, in turn, could be synthesized into broader process categories or key process areas (KPAs). The most commonly used elements of the maturity status are the levels of maturity or its dimensions, which are defined using the maturity assessment criteria.

The Framework suggested by the author includes 4 KPAs; each of the KPAs contains a number of practices; in total, there are 34 practices inside the Framework. In Table 16.2, the author presents the 4 KPAs of the suggested Framework, the number of practices inside each of the KPAs, and the weights given to each of the KPA.

Table 16.2. Education personalization maturity framework: key process areas

Key process area	KPA Acronym	Weight	Practices inside the KPA
Students' Platform	SPL	0.100	SPL1 – SPL7
Courses and Fields of Study	CFS	0.400	CFS1 – CFS15
Research Activity	RSA	0.300	RSA1 – RSA4
Extracurricular Activities	EXA	0.200	EXA1 – EXA9

Source: own study.

The weights of the KPAs are used to calculate the weighted average (W_{HEI}) for the assessed HEI. Previously, the weights of the practices are used to calculate the weighted average (W_{KPA}) for each KPA. Generally, the weighted average (W) is calculated as follows (Equation 1):

$$W = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \tag{1}$$

where

n – is the number of elements to be averaged,

w_i – are the weights of the elements (practices or KPAs),

X_i – are the values of maturity assessment criteria obtained for each practice or KPA.

In the suggested Framework, maturity of personalization is assessed with the application of the five maturity assessment criteria with the values from 0 to 4, as shown in Table 16.3.

Table 16.3. Personalization maturity assessment criteria

Defined value	Description of the value
0 – not assessed	There is no evidence of the given practice at the HEI.
1 – initial	There is some evidence of the given practice at the HEI; this performance can be mostly ad hoc and inconsistent.
2 – partially adequate	The given practice is formally defined within the HEI to some degree; it still lacks consistency in performance.
3 – largely adequate	The given practice is formally defined within the HEI; there is consistency in performance; the institution is lacking suggestions for potential improvements in the given practice in the future.
4 – Fully adequate	The given practice is formally defined within the HEI; the institution is consistent in its performance; there is documented reflection on the usage of the practice for further improvements.

Source: adapted from (Anicic & Divjak, 2020).

For each of the 34 practices inside the 4 KPAs, each of the maturity assessment criteria contains the suggested description of the case at a HEI, assessed with the Framework. In the process of HEI assessment, one case for each practice is supposed to be selected. At this moment, the practice obtains a particular value of the assessment criteria (from 0 to 4). The values of maturity assessment criteria for each practice inside one KPA are used to calculate the weighted average for each KPA, which is then transformed into the value of maturity assessment criteria for KPAs. The explained methodology is presented with Table 16.4, using the example of two practices (EXA4 and EXA5) inside the "Extracurricular Activities" KPA.

Table 16.4. Education personalization maturity framework: case presentation

Practices / Assessment criteria	EXA4 Infrastructure (weight $w_i = 0{,}194$)	EXA5 Access to databases and electronic resources (weight $w_i = 0{,}167$)
0 Not assessed	The HEI does not provide students with access to rooms other than classrooms within the course schedule.	The HEI does not provide students with access to any databases or electronic resources.

Table 16.4. cnt'd

Practices Assessment criteria	EXA4 Infrastructure (weight $w_i = 0{,}194$)	EXA5 Access to databases and electronic resources (weight $w_i = 0{,}167$)
1 Initial	The HEI provides students with a computer room where they can work. The room is small; has short opening hours; it might be not available on weekends.	The HEI provides students with access to some databases or other electronic resources. Access is possible only from computers in the HEI's library.
2 Partially adequate	The HEI provides students with a few computer rooms where they can work. The rooms are big; have short opening hours; might be not available on the weekend.	The HEI provides students with access to most of the largest databases or other electronic resources. Access is possible only from computers in the HEI's library.
3 Largely adequate	The HEI provides students with several computer rooms where they can work. The rooms are big; they are open for students all the time, also on weekends.	The HEI provides students with access to most of the largest databases or other electronic resources. Access is possible from all computers at the HEI.
4 Fully adequate	The HEI leaves all the classrooms, equipped with computers, open for students.	The HEI provides students with access to most of the largest databases or other electronic resources. Access is also possible from students' private computers.

Source: own study.

In the example, the case selected for EXA4 is on the "initial" level (value 1), while the case with EXA5 is on the "largely adequate" level (value 3). Then, using Equation 1 to calculate the weighted average W_{KPA} for the "Extracurricular Activities", the following is obtained (Equation 2):

$$W_{KPA} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} = \frac{(0{,}194 * 1) + (0{,}176 * 3)}{(0{,}194 + 0{,}176)} = 1{,}951 \qquad (2)$$

where

$n = 2$ (two practices to be averaged),

w_i – are the weights of the practices EXA4 and EXA5,

X_i – are the values of maturity assessment criteria (1 for EXA4, and 3 for EXA5).

The "Extracurricular Activities" KPA obtains the weighted average $W_{KPA} = 1{,}951$, which gives this KPA level 2 – "partially adequate". Once all the 4 KPAs obtain their weighted averages and then the levels, we can proceed to calculating the weighted average (W_{HEI}) for the assessed HEI in general; where the X_i for "Extracurricular Activities" will be 2, and its w_i will be 0, 2 (see Table 16.2). As a result of the overall assessment of a particular HEI with the application of the Framework, the conclusion (example) is obtained (Table 16.5).

Table 16.5. Education personalization maturity framework: example results of assessment

1. STUDENTS' PLATFORM			
The maturity level of the HEI for the key process area is	1	Initial	There is some evidence of the given practice at the HEI, but this performance can be mostly ad hoc, informal and inconsistent.
2. COURSES AND FIELDS OF STUDY			
The maturity level of the HEI for the key process area is	3	Largely adequate	The personalization of education is formally defined within the HEI to some degree, but it still lacks consistency in performance.
3. RESEARCH ACTIVITY			
The maturity level of the HEI for the key process area is	0	Not assessed	There is no evidence of personalization of education at the HEI.
4. EXTRACURRICULAR ACTIVITIES			
The maturity level of the HEI for the key process area is	2	Partially adequate	The personalization of education is formally defined within the HEI to some degree, but it still lacks consistency in performance.
The OVERALL LEVEL OF PERSONALIZATION OF EDUCATION at the selected Higher Education Institution can be assessed as:			
Partially adequate			

Source: own study.

5. Conclusion

The education personalization maturity framework presented briefly in the paper, is the author's development. The work on the Framework is conducted as a part of a PhD candidate's work. The 4 KPAs and 34 practices inside these areas were selected and formulated based on students' opinions (284 respondents), obtained through a survey conducted at the HEI where the author works.

At the next step of the research, the Framework will be verified by experts –academic teachers and administrative staff of other HEIs in the country and abroad. Then, changes and improvements will be implemented. The verification will be conducted in two stages: 1) the Framework is sent to a few experts – to find out whether it is constructed in a form that is comfortable to read, whether all the descriptions are clear and unambiguous; 2) after the Framework is changed (if necessary) and becomes more understandable and readable, it is sent to a larger group of experts in a few countries to verify if the Framework considers all the processes connected with education personalization at HEIs, whether the practices and cases suggested are sufficient for HEIs assessment.

The Framework is supposed to contribute to the theory and practice of higher education management, within the discipline of management and quality

sciences[2]. With further elaboration, the Framework could include recommendations on education personalization development and improvement. Without the mentioned expansion, in a form that is suggested presently, the Framework is to help HEIs to assess whether they provide their students with enough opportunities to build their Individual Profile and to offer possible ways for such opportunities.

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PART III   BUSINESS MANAGEMENT CHALLENGES IN THE DIGITAL ECONOMY

The Efficiency Measure Based on Corporate Sustainability Performance as a Criterion for the Classification of Companies[1]

Agnieszka Matuszewska-Pierzynka

1. Introduction

Sustainable development is generally understood as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 41). The concept of sustainable development has evolved over the years shifting more and more attention to the need for full integration of environmental, social and economic dimensions as well as the importance of corporations in promoting its principles (Giovannoni & Fabietti, 2013, pp. 23–28). At present it is believed that corporations should play a key role in implementation of sustainable development practices as, on the one hand, they are largely responsible for environmental deterioration and social inequality, but on the other, they have powerful capacity to influence societies and create innovations, which is necessary to pursue this concept (Gray, 2010, pp. 56–58).

Corporate sustainability can be defined as "meeting the needs of a firm's direct and indirect stakeholders (…) without compromising its ability to meet the needs of future stakeholders" (Dyllick & Hockerts, 2002, p. 131). In order to meet the needs of different stakeholder groups, corporations must actually satisfy all three dimensions of sustainability, which requires maintaining and enhancing of economic, human and natural capital at the same time (Oželienė, 2017, pp. 97–101). It is necessary to highlight that the precondition for environmental, social

and economic sustainability of a company is good governance, which nowadays is recognized as the fourth dimension of corporate sustainability (UN, 2012, p. 65).

The theoretical business models for sustainability, which provide for the integration of economic, environmental, social and governance activities in the process of creating values for multiple stakeholders, suggest that the implementation of its principles leads to the appearance of positive financial effects in the company (Kantabutra & Ketprapakorn, 2020, pp. 18–19; Perrini *et al.*, 2011, pp. 59–76). This suggestion finds the support in some empirical studies employing panel regression models mainly to investigate the relationship between corporate sustainability performance (CSP) and corporate financial performance (CFP), as measured by return on assets/equity or Tobin's q (Tuppura *et al.*, 2016, pp. 672–686; Wagner, 2010, pp. 1553–1560). However, to the best of the author's knowledge, none of the researchers has not already evaluated the largest companies in term of their efficiency, which would take into account corporate sustainability performance as well as made any comparison of them with the use of such a criterion to reveal the leader. Therefore, the essential aim of this paper is to answer the question whether the use of an efficiency measure based on corporate sustainability pillar scores as a criterion for classifying the largest U.S. companies brings about changes in a leading position of the Fortune 500 ranking.

The main method of conducted empirical research was Data Envelopment Analysis (*DEA*), which allowed assessing the efficiency of a company with the use of sustainability performance in its particular dimensions. The empirical studies were carried out between 2015–2019 among the largest U.S. non-financial companies, which were listed at least once in the top 10 of the Fortune 500 ranking for the 2016–2020 period. The financial and sustainability data of investigated companies from 2014–2019 were retrieved from *Refinitiv Thomson Reuters* database and efficiency measures were calculated applying free *DEA Frontier* software. In order to characterize variables being outputs and inputs in the employed input-oriented *CCR* model, which is regarded as the basic model in the *DEA* method, their descriptive statistics were analysed.

2. The Cobb-Douglas Production Function and DEA Method – Research Methodology

The research sample includes the largest U.S. companies, which were listed in the top 10 of the Fortune 500 ranking at least once over the 2016–2020 period. The adoption of such a condition for companies listed in this ranking allowed only the best largest U.S. companies to be qualified for the research sample. On the basis of this precondition, 12 companies were qualified for the research sam-

ple but one of them was excluded because it operates in the financial sector[2]. The final research sample consists of 11 largest U.S. non-financial companies, which were in the top 10 of the Fortune 500 ranking at least once during the 2016–2020 period. Walmart Inc. was in the leading position of this ranking in each year of the period. The research period covers the years 2015–2019[3], but because one-period lagged variables and variables as expressed in average values were applied, it was necessary to collect all required data for the years 2014–2019. The financial and sustainability data of investigated companies for the years 2014–2019 were retrieved from *Refinitiv Thomson Reuters* database and the free *DEA Frontier* software was employed to calculate efficiency measures.

Bearing in mind the main aim of this paper, the research hypothesis, stating that Walmart Inc. remains the leader of the largest U.S. companies even when the efficiency measure based on the corporate sustainability performance becomes the main criterion for classifying these companies, was formulated.

This research hypothesis was verified with the use of an augmented production function, which in a logarithm form (Conte & Svejnar, 1988, pp. 139–151) looks as follows:

$$lnV = lnA + \alpha_1 lnK + \alpha_2 lnL + \beta X \tag{1}$$

From the collected data, three operating variables were constructed:
- V (output) – total revenues, which are the main criterion for classifying the largest U.S. companies in the Fortune 500 ranking (real values – nominal values deflated by $CPI_{2014}=0$),
- K (capital input) – average fixed assets (real values – nominal values deflated by $CPI_{2014}=0$) and
- L (labour input) – average employment (part-time employment was converted into full-time employment).

X is a vector, which contains variables of corporate sustainability performance.

Taking into account constructed variables as well as denoting companies by i, the time period in years by t ($t = 1, 2, …$) and residual by μ, the basic Cobb–Douglas production function is:

$$lnV_{i,t} = \alpha_0 + \alpha_1 lnK_{i,t} + \alpha_2 lnL_{i,t} + \beta X_{i,t-1} + \mu_{i,t} \tag{2}$$

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[2]   The financial company was excluded from the research sample because of its specificity. Including this company in the research sample would lead to the lack of comparability of some variables between companies.

[3]   The Fortune 500 ranking in 2020 was prepared according to total revenues from 2019.

where vector X is composed of[4]:

- *LTRPS* (long-term returns pillar score) – measure which represents a company's ability to manage its long-term economic sustainability (earnings sustainability, credit risk and level of investment),
- *EPS* (environmental pillar score) – measure which shows a company's effectiveness in avoiding environmental risk and taking advantage of environmental opportunities (resource use, emissions, innovations),
- *SPS* (social pillar score) – measure which refers to the company's reputation and the status of its license to operate (workforce, human rights, product responsibility) and
- *GPS* (governance pillar score) – measure which reflects a company's capacity to direct and control its rights and responsibilities (management, shareholders, *CSR* responsibility).

All corporate sustainability pillar scores take values from 0 to 100 and should be interpreted under the scale below:

- <0–25) – poor score,
- <25–50) – satisfactory score,
- <50–75) – good score and
- <75–100) – excellent score.

Efficiency measures based on the corporate sustainability performance were calculated with the use of the Data Envelopment Analysis (*DEA*) method, which derives from the classic measure of productivity defined as the ratio of a single output to a single input (Debreu, 1951, pp. 273–292; Farrell, 1957, pp. 253–290). The *DEA* method enables calculating the relative technical efficiency of decision making units (*DMUs*), understood as the relation between productivity of a given *DMU* to the productivity of efficient *DMU*, estimating the ratio of multiple outputs to multiple inputs (Domagała, 2007, p. 23). The efficiency of a given decision making unit (*DMU*) measured by the *DEA* method is described by the following formula (Kucharski, 2014, p. 11):

$$e_i(u,v) = \frac{\sum_{o=1}^{p} u_{o,i} y_{o,i}}{\sum_{r=1}^{s} v_{r,i} x_{r,i}} \tag{3}$$

where:

- $e_i(u,v)$ – efficiency measure for *i-th DMU*,
- i – index denoting a given *DMU* ($i = 1, \ldots, n$)
- p – number of outputs, ($o = 1, \ldots, p$),
- s – number of inputs, ($r = 1, \ldots, s$),

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[4] The description of corporate sustainability variables is based on information found in *Refinitiv Sustainable Leadership Monitor* database.

- $u_{o,i}$ – weight of *o-th* output for *i-th DMU*,
- $v_{r,i}$ – weight of *r-th* input for *i-th DMU*,
- $y_{o,i}$ – *o-th* output of *i-th DMU* and
- $x_{r,i}$ – *r-th* input of *i-th DMU*.

It should be underlined that the *DEA* method can be implemented in the efficiency assessment of different *DMUs* (Matuszewska-Pierzynka, 2020, pp. 313–333; Sajnóg & Sosnowski, 2015, pp. 55–76; Sueyoshi & Goto, 2012, pp. 668–678; Tsai *et al.*, 2016, pp. 1–17) because it provides the opportunity to take into account many heterogeneous inputs and outputs[5] without the need to determine their weights[6] and functional relationship[7].

The estimation of efficiency measures with the *DEA* method can be made in the framework of four different models in terms of their assumptions:

- a model with constant returns to scale (*CRS*)[8] – *CCR* model[9] (Charnes *et al.*, 1985, pp. 91–107),
- a model with variable returns to scale (*VRS*)[10] – *BCC* model (Banker *et al.*, 1984, pp. 1078–1092),
- a model with non-increasing returns to scale (*NIRS*) (Fäare *et al.*, 1985) and
- a model with non-decreasing returns to scale (*NDRS*) (Ylvinger, 2000).

Moreover, the *DEA* method allows estimating efficiency measures in three various forms:

- input-oriented efficiency – minimizing inputs in conditions of unchanged outputs,
- output-oriented efficiency – maximizing outputs in conditions of unchanged inputs and
- efficiency without the orientation.

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[5] Inputs and outputs can be expressed in diverse units, even not monetary ones but their values cannot be negative as well as at least one input and at least one output for each *DMU* must be different from zero.

[6] Weights of inputs and weights of outputs, which define their importance and maximize the efficiency of each *DMU* are generated during the estimation of *DEA* efficiency measures.

[7] The *DEA* method as a non-parametric technique does not require to define the production function to present the functional dependence between inputs and outputs.

[8] In the *DEA Frontier* software, the model with constant returns to scale is known as the *CRS* model. The same model in the economic literature is marked from the names of its authors (A. Charnes, W.W. Cooper and A. Rhodes) as *CCR*.

[9] *CCR* model is regarded as the main model in the *DEA* method because other models are its modification.

[10] In the *DEA Frontier* software, the model with variable returns to scale is known as the *VRS* model. The same model in the economic literature is marked from the names of its authors (R.D. Banker, A. Charnes and W.W. Cooper) as *BCC*.

The efficiency measure in *DEA* method takes values between 0 and 1, but the value equal to 1 marks the full efficiency of a given *DMU*. A given *DMU* is fully efficient if and only if it is not possible to make any inputs or outputs better off (decrease of inputs or increase of outputs) without making the others worst off (increase of inputs or decrease of outputs), which means that DEA efficiency is Pareto efficiency (Charnes *et al.*, 1978, p. 433). The full efficient *DMU* sets the efficiency limit, which as the limit of production capacity for the whole group of entities may be used by inefficient *DMUs* in searching for the optimal level of inputs (Domagała, 2007, p. 25). The degree of inefficiency in a given *DMU* is determined by the difference between 1 and calculated measure of *DEA* efficiency $e_i(u,v)$ (Kucharski, 2014, p. 10).

Estimating efficiency measures based on corporate sustainability performance, the input-oriented *CCR* model, where total revenues are treated as the output while average fixed assets, average employment and corporate sustainability pillar scores are inputs, was used.

3. The Efficiency Measure Based on Corporate Sustainability Performance – Results of Empirical Studies

The empirical studies are based on the analysis of 11 largest U.S. companies between the years 2015–2019. Walmart is the unquestioned leader of the Fortune 500 ranking as it took the first position in this ranking in each year in 2016–2020. Seven companies were listed in the top 10 of the Fortune 500 ranking over the whole 2016–2020 period – two companies were in the top 10 of this ranking three times and two only twice (see Table 17.1).

Table 17.1. Classification of the largest U.S. companies in the Fortune 500 ranking in the years 2016–2020

Company	2016	2017	2018	2019	2020
Walmart Inc.	1	1	1	1	1
Amazon.com Inc.	18	12	8	5	2
Exxon Mobil Corp.	2	4	2	2	3
Apple Inc.	3	3	4	3	4
CVS Health Corp.	7	7	7	8	5
UnitedHealth Group Inc.	6	6	5	6	7
McKesson Corp.	5	5	6	7	8
AT&T Inc.	10	9	9	9	9
AmerisourceBergen Corp.	12	11	12	10	10
Ford Motors Co.	9	10	11	12	12
General Motors Co.	8	8	10	13	18

Source: own elaboration based on data retrieved on April 16, 2021, from https://fortune.com/fortune500/.

Total revenues, being the output in the input-oriented *CCR* model as well as the classification criterion of the largest U.S. companies in the Fortune 500 ranking, ranged from 106,879.59 to 485,188.29 million US dollars. The highest total revenues were observed in 2019 in Walmart Inc., which was the leader of this ranking in each year of the 2016–2020 period. The lowest total revenues were recorded in 2015 in Amazon.com Inc., which shifted in the ranking from 18th place in 2016 to 2nd place in 2020. The mean of total revenues systematically increased from 193,527.65 million American dollars in 2015 to 227,479.88 million American dollars in 2019. The average value of fixed assets representing the capital input in the Cobb-Douglas production function and the *CCR* model was the highest in 2019 in AT&T Inc. (456,539.05 million American dollars) and the lowest in 2015 in AmerisourceBergen Corp. (6,175.99 million American dollars). The mean of average fixed assets increased gradually from 118,033.76 million American dollars in 2015 to 160,067.70 million American dollars in 2019. The average value of fixed assets in Walmart Inc. was below the mean for all examined companies only between the years 2018–2019. The average number of employees reflecting the labour input in the Cobb-Douglas production function and the *CCR* model was the highest in 2016 and 2017 in Walmart Inc. (2,300,000.00 employees in each of these two years) and the lowest in 2015 in AmerisourceBergen Corp. (14,750.00 employees). The mean of average employment increased steadily from 341,020.45 employees in 2015 to 405,154.55 employees in 2019. Walmart Inc. was the largest employer over the whole 2015–2019 period (see Table 17.2).

Table 17.2. Descriptive statistics of operating variables for the largest U.S. companies in the years 2015–2019 (N = 11)

Specification		2015	2016	2017	2018	2019
Total revenues	Mean	193,527.65	198,157.29	206,678.47	220,443.81	227,479.88
	Std. Dev.	103,951.21	96,574.70	96,416.75	96,631.39	96,088.45
	Min.	106,879.59	134,134.25	140,610.73	138,633.99	127,080.84
	Max.	481,560.44	479,253.26	483,237.61	484,967.70	485,188.29
	Median	153,108.91	175,127.04	178,468.66	202,054.40	222,488.00
Average fixed assets	Mean	118,033.76	131,510.59	138,591.01	150,151.00	160,067.70
	Std. Dev.	106,414.16	113,564.75	110,601.60	116,222.55	123,918.07
	Min.	6,175.99	9,129.52	10,637.77	10,869.30	10,662.55
	Max.	314,737.41	363,359.88	356,473.61	402,708.92	456,539.05
	Median	80,626.74	104,665.13	132,288.30	135,310.99	142,532.00
Average employment	Mean	341,020.45	361,170.45	381,459.09	396,640.91	405,154.55
	Std. Dev.	637,645.18	648,944.69	647,371.02	634,866.72	624,697.81

Table 17.2. cnt'd

Specification		2015	2016	2017	2018	2019
	Min.	14,750.00	17,250.00	19,000.00	20,500.00	21,500.00
	Max.	2,250,000.00	2,300,000.00	2,300,000.00	2,250,000.00	2,200,000.00
	Median	188,400.00	201,500.00	202,500.00	200,500.00	194,500.00

Note: Total revenues and average fixed assets are expressed in million US dollars while average employment is measured by the number of employees.

Source: own calculations based on the data retrieved on January 14, 2021, from Refinitiv Thomson Reuters Eikon database available at the Faculty of Economics and Sociology, University of Lodz.

The means of scores in every corporate sustainability pillars revealed a growing tendency in the years 2014–2018, but only the means of scores in environmental and social pillars exceeded the level of 75.00, above which scores are regarded as excellent. The highest scores in all particular pillars – environmental (90.50 – Exxon Mobil Corp./2017), social (93.18 – General Motors Co./2017), governance (87.51 – AmerisourceBergen Corp./2018) and long-term returns (91.00 – McKesson Corp./2015 and 2018) – were at the excellent level. The lowest scores in social pillar (36.97 – AmerisourceBergen Corp./2014) and in governance pillar (29.60 – Ford Motors Co./2014) were at the satisfactory level while the lowest scores in long-term returns pillar (20.67 – Exxon Mobil Corp./2016) and in environmental pillar (0.00 – AmerisourceBergen Corp./2014) should be viewed as poor. The scores of Walmart Inc. in any sustainability pillars were above the means for all tested companies over the whole 2014–2018 period except the social pillar, where the score in 2017 was slightly below the mean (see Table 17.3).

Table 17.3. Descriptive statistics of sustainability pillar scores for the largest U.S. companies in 2014–2018 (N = 11)

Specification		2014	2015	2016	2017	2018
Environmental pillar score	Mean	58.16	61.75	65.71	68.97	76.36
	Std. Dev.	29.28	28.51	24.16	20.17	15.08
	Min.	0.00	5.58	18.03	21.73	41.15
	Max.	88.26	89.75	89.69	90.50	89.73
	Median	67.97	75.00	76.93	74.71	79.57
Social pillar score	Mean	63.09	67.80	72.93	73.59	75.10
	Std. Dev.	18.87	18.10	14.64	13.47	13.66
	Min.	36.97	42.24	50.55	49.30	49.64
	Max.	88.65	89.34	92.62	93.18	91.69
	Median	58.95	62.90	75.33	73.66	75.24

Table 17.3. cnt'd

Specification		2014	2015	2016	2017	2018
Governance pillar score	Mean	68.43	69.88	68.43	71.02	72.82
	Std. Dev.	20.40	8.24	18.65	17.27	16.85
	Min.	29.60	53.63	35.73	40.58	40.11
	Max.	86.95	79.87	86.28	85.32	87.51
	Median	77.93	71.57	75.63	79.60	80.25
Long-term returns pillar score	Mean	62.67	63.88	63.88	63.27	65.70
	Std. Dev.	22.14	22.36	23.10	23.00	20.35
	Min.	30.00	30.00	20.67	30.00	30.00
	Max.	89.00	91.00	89.00	90.33	91.00
	Median	68.67	66.33	75.33	73.67	67.00

Source: own calculations based on the data retrieved on January 14, 2021, from Refinitiv Sustainable Leadership Monitor database available at the Faculty of Economics and Sociology, University of Lodz.

The mean of efficiency measures, which were calculated including corporate sustainability pillar scores, ranged between 0.87 in 2015 and 0.94 in 2016. The highest possible efficiency measure (1.00), which marks the full efficiency of a given decision-making unit, was identified in seven companies, but in five of them it appeared in each year of the 2015–2019 period – Walmart Inc., Exxon Mobil Corp., Apple Inc., McKesson Corp. and AmerisourceBergen Corp. It is worth emphasizing that between 2016 and 2018 AmerisourceBergen Corp. was beyond the top 10 of the Fortune 500 ranking as well as characterized the highest governance pillar score in 2018 and the lowest scores in social and environmental pillars in 2014. Ford Motors Co.'s efficiency measure equalled 1.00 only in 2015–2016 when it was listed in the top 10 of this ranking while CVS Health Corp. gained full efficiency when it was in the 7th and 5th positions. The lowest efficiency measure (0.59) was noted in 2015 in Amazon.com Inc., which became a vice-leader of the Fortune 500 ranking in 2020 although it did not achieve full efficiency in this year (see Table 17.4).

Referring to the sustainability pillar scores of companies, which achieved full efficiency in each year of the period 2015–2019, it must be indicated that they were very differentiated. Apple Inc. and McKesson Corp. achieved good average scores in environmental and social pillars as well as excellent average scores in governance and long-term returns pillars. Exxon Mobil Corp. had excellent average scores in environmental and social pillars but its average score in governance pillar was at a good level whereas an average score in long-term returns pillar was satisfactory. AmerisourceBergen Corp. had poor average score in environmental pillar but excellent average score in governance pillar while all average scores in particular sustainability pillars of Walmart Inc. were at excellent levels (see Table 17.5).

Table 17.4. Efficiency measures based on sustainability pillar scores for the largest U.S. companies in the years 2015–2019 with descriptive statistics (N = 11)

	Specification	2015	2016	2017	2018	2019
Company	Walmart Inc.	1.00	1.00	1.00	1.00	1.00
	Amazon.com Inc.	0.59	0.70	0.81	0.79	0.80
	Exxon Mobil Corp.	1.00	1.00	1.00	1.00	1.00
	Apple Inc.	1.00	1.00	1.00	1.00	1.00
	CVS Health Corp.	0.77	1.00	0.98	0.87	1.00
	UnitedHealth Group Inc.	0.72	0.95	0.77	0.87	0.90
	McKesson Corp.	1.00	1.00	1.00	1.00	1.00
	AT&T Inc.	0.64	0.82	0.81	0.74	0.83
	AmerisourceBergen Corp.	1.00	1.00	1.00	1.00	1.00
	Ford Motors Co.	1.00	1.00	0.84	0.91	0.98
	General Motors Co.	0.84	0.84	0.72	0.79	0.74
Metrics	Mean	0.87	0.94	0.90	0.91	0.93
	Std. Dev.	0.16	0.10	0.11	0.10	0.10
	Min.	0.59	0.70	0.72	0.74	0.74
	Max.	1.00	1.00	1.00	1.00	1.00
	Median	1.00	1.00	0.98	0.91	1.00

Source: own calculations based on the data retrieved on January 14, 2021, from Refinitiv Sustainable Leadership Monitor database available at the Faculty of Economics and Sociology, University of Lodz made with the use of DEA Frontier software.

Table 17.5. Means of sustainability pillar scores in the largest U.S. companies for the years 2014–2018

Company	Environmental pillar score	Social pillar score	Governance pillar score	Long-term returns pillar score
Walmart Inc.	77.76	77.30	79.79	79.00
Amazon.com Inc.	39.73	67.17	82.13	89.00
Exxon Mobil Corp.	86.13	79.87	53.03	35.33
Apple Inc.	53.62	56.94	82.68	83.67
CVS Health Corp.	89.05	86.84	71.69	58.67
UnitedHealth Group Inc.	71.30	68.24	81.19	75.67
McKesson Corp.	56.24	53.79	77.83	85.67
AT&T Inc.	78.45	65.43	47.21	51.67
AmerisourceBergen Corp.	17.30	45.74	79.01	74.00
Ford Motors Co.	73.31	84.60	69.50	38.67
General Motors Co.	85.22	89.61	47.23	31.33

Source: own calculations based on the data retrieved on January 14, 2021, from Refinitiv Sustainable Leadership Monitor database available at the Faculty of Economics and Sociology, University of Lodz.

4. Conclusion

Walmart Inc. is the undisputed leader of the Fortune 500 ranking because it was listed in the leading position of this ranking in each year between 2016 and 2020. The average total revenues of Walmart Inc. in the years 2015–2019 amounted to 482,847.46 million US dollars. The efficiency measure calculated on the basis of corporate sustainability pillar scores for Walmart Inc. was equal to 1.00 in each year of the 2015–2019 period, which means that it was a fully efficient company over that time. Walmart Inc. did not lose the first position in the ranking of the largest U.S companies even when the efficiency measure based on corporate sustainability performance was used as an assessment criterion of companies. However, the empirical studies revealed that four other companies, which were listed in the top 10 of Fortune 500 ranking between the years 2016–2020 were also characterised by the highest possible measure of efficiency (1.00) in each year of the 2015–2019 period. It means that Exxon Mobil Corp., Apple Inc., McKesson Corp. and AmerisourceBergen Corp. should be also regarded as fully efficient companies just like Walmart Inc.

Referring to the aim of the paper and the formulated research hypothesis, it should be pointed out that Walmart Inc. remained the leader in the ranking of the largest U.S. companies when their classification was made with the use of the efficiency criterion based on the corporate sustainability performance, but four other companies – Exxon Mobil Corp., Apple Inc., McKesson Corp. and AmerisourceBergen Corp. – also took a leading position.

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The Cost Deployment Concept – Methodological Outline[1]

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1. Introduction

It is extremely important to assess clearly the costs and benefits in a business run. In order to increase productivity, a better understanding of cost structure must be obtained. Most of traditional reporting systems, especially in manufacturing enterprises, reveal a quantifiably weak correlation between the proposed or introduced improvements and the benefits that these improvements can bring. The concept of cost deployment is an example of a rational and systematic tool supporting the optimization of improvements in a manufacturing company. The results obtained as the outcome of the cost deployment process may constitute the basis for making subsequent management decisions. They can not only support a cost reduction plan but also provide information about root causes of existing inefficiencies.

2. The Substance, Assumptions and Goals of Cost Deployment

The very nature of competition in business forces production companies to constantly introduce improvements to their production processes and refine the solutions which they have used so far. Gaining a competitive advantage may take place through gaining a cost advantage or by creating a unique usability of the product as attributed to it by the end customer, e.g. its superior quality. Businesses, especially those with WCM (World Class Manufacturing) status, strive to eliminate all unnecessary operating costs that do not bring added value, i.e. generate losses, in order to achieve a cost advantage. The term WCM, derived

from the concept of Lean (Womack & Jones, 1996) was introduced by Hayes and Wheelwright (1984), who presented it as a set of principles, practices and techniques that would lead an enterprise to excellent results (Flynn, Schroeder & Flynn 1999). They did not analyze, however, the necessary changes to management accounting, cost accounting or controlling systems that would allow for the quantification of results obtained by the use of these techniques and activities. The work of Schonberger (1986) was focused on factors contributing to waste and delays in the production process. He did not refer to the complex cost measurement of the production process, much less to the measurement of the improvements that were made. This was achieved only thanks to the application of the Cost Deployment concept, an idea which seeks to identify, quantify and indicate the most cost-effective activities aimed at eliminating losses in the production process. Cost Deployment is a method used in world production systems – WCM (Yamashina & Kubo, 2000; Dudek, 2014; Piasecka-Głuszak, 2017). The introduction of WCM is based on two pillars: one concerned with management and the other concerned with technical issues. Management pillars are a set of guidelines supporting the introduction of the technical pillars. Cost Deployment is the first among the technical pillars to be introduced. (Table 18.1).

Table 18.1. Technical and managerial pillars in World Class Manufacturing

No.	Technical pillars	Managerial pillars
1	CD – Cost Deployment	MC – Management Commitment KPI (Clarity of Objectives)
2	AM – Autonomous Maintenance WO – Workplace Organization	Route map to WCM
3	PM – Professional Maintenance	Allocation of Highly Qualified People to Model Areas
4	QC – Quality Control	Commitment of the Organization
5	Logistics and customer service LCS, L – Logistic CS – Customer Service	Competence of Organization towards Improvement and Problem solving
6	EEM – Early Equipment & Product Management EPM – Early Product Management	Time and Budget
7	PD – People Development	Level of Detail
8	S – Safety	Level of Expansion
9	EM – environmental Management	Motivation of operators

Source: (Piascecka-Głuszak 2017, p. 57).

2. Levels and Goals of Using Cost Deployment in the Enterprise

The purpose of cost analysis as part of Cost Deployment is to identify losses arising in the production process. The uniqueness of the method consists primarily in indicating the cause and effect relationship of the resulting loss and its quantification. Indication of the cause of these losses leads not only to identifying the source of the losses and quantifying them, but also to the proper selection of the most effective method of eliminating such losses from both a technical and economic point of view. Changing the character and perception of the processes that are taking place is based on four pillars: synchronization, transparency, orientation towards creating added value and continuous improvement of both processes and the use of resources. It is reasonable to implement these principles simultaneously and also on many levels of the company's activity, not just to limit them to only single processes. Repeatability and the proper sequence of actions are necessary elements. The goals set for the participants of this process must be clear and measurable, traits which also apply to the results of their activities (Chiarini & Vagnoni, 2015). The "top-down" principle for the definition and implementation of goals perfectly fits into some of the basic assumptions of the analysis, i.e. perception, implementation and organization of processes, taking into account the entire enterprise and not only individual departments. Each goal must be defined in such a manner as to be synchronized with the other goals. In this way, consistency of the processes taking place within the company is achieved (Figure 18.1).

Clearly defined goals, identification of the sources of losses generated and their valorization allow for the selection, adaptation and implementation of appropriate Lean Production methods in order to eliminate the sources of such losses (Parmenter, 2015). Managing a company according to the Lean principles not only means improvement in the normal course of business. It also means the mode of operation is oriented towards key goals like creating value for the customer, directing production to the value stream and continuous improvement of the flow of the product or service value stream (Maskell & Kennedy, 2007). This approach, combined with strategies aimed at eliminating waste, constitutes a complete change in the approach to the organization and management of a manufacturing enterprise. Cost Deployment is a method that combines traditional cost accounting, Lean Accounting and management controlling. It is a response to traditional cost accounting systems that are used by many companies but have not met the needs of these organizations that have to cope with a dynamically and constantly changing environmental economy characterized by shorter product life cycles and hyper competition (Horngren, Datar & Foster,

2008). It is a method that requires a competitive strategy that is focused on customers, quality, time and price of products (Szychta, 2007). Cost Deployment is a method to empower and feed the information-based decision-making process in an enterprise. It is subordinated to and focused on the fundamental assumptions of Lean Management and the terms Lean Management, Lean Manufacturing and Lean Accounting are inextricably linked (Kennedy & Brewer, 2006). Lean Accounting (LA) can be broadly described as (Sobańska, 2013; Maskell, Baggaley & Grasso, 2011):
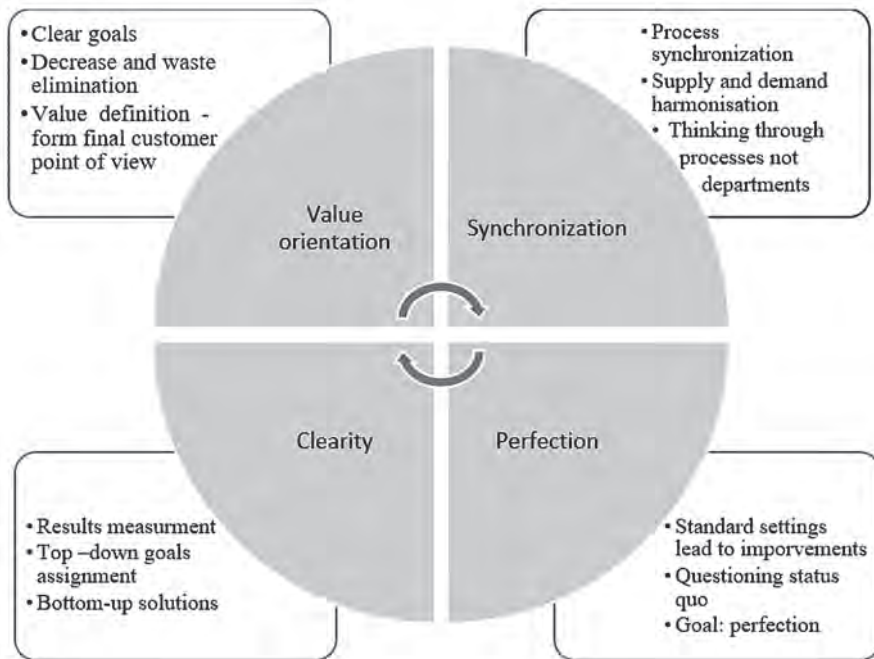
Figure 18.1. Principles of synchronization of processes in the enterprise
Source: (Preparatory materials for the Cost Deployment project of the analyzed enterprise 2016).

- timely delivery of relevant and clear information needed to make decisions, adding value to the customer and the profitability of the organization;
- elimination of waste in processes related to the execution of transactions;
- reporting;
- providing comprehensive information support for the implementation and use of Lean Management in the enterprise, providing relevant, up-to-date, easy-to-understand information, enabling the calculation and analysis of costs oriented towards the value stream of a product group, not on the production of a product or delivery of a service (Kaplan & Norton, 1996);

- enabling the creation of a performance measurement system in line with the Lean Management concept,
- supporting a budgeting and control system focused on those responsible for achieving results, and this budgeting process begins at the highest strategic level.

3. Characteristics of the Cost Deployment Research Procedure

The Cost Deployment method, being one of the pillars of WCM implementation in a company, consists of specific, consecutive stages. Cost Deployment, like other pillars, has seven steps or stages. These stages are part of a consecutive order, but carrying out all seven does not mean the completion of the whole process of analysis and improvement. As mentioned earlier, it is necessary to implement constant revision and analysis of the ongoing processes, as well as to constantly ask the question whether what has already been achieved is all that was possible to achieve.

The Cost Deployment process itself leads to an indication of the relationship between the identification of emerging losses and the determination of their economic value (Silva, Kovaleski, Gaia, Garcia & Andrade Júnior 2013). This is done with the use of matrices that allow for a schematic presentation of the processes taking place, making it possible to indicate the relations between individual departments and processes, while stratifying existing processes and phenomena in a transparent and schematic manner. This approach allows the company to distinguish both the importance of the phenomena taking place and to indicate which of them are the causes of the losses, and which losses are the result of other factors (Petrillo, Felice & Zomparelli, 2017).

The seven steps that make up the entire process are individual stages that follow one another, with each succeeding step being a continuation of the previous one and, at the same time, an indication of actions that should be taken as a result of the subsequent analysis (Figure 18.2).

The results of individual stages are various matrices which are created and which clearly and unambiguously indicate the areas of greatest interest.

Steps 1 and 2. Analysis of the Transformation Process and Matrix A.

The initial phase allows companies to understand and precisely analyze the entire production process. Factors such as costs, the transformation process, the nature of costs, and the places where they arise are subject to detailed analysis. Due to their nature and importance the most frequently analyzed areas are the 5 macro categories of losses resulting from: machine parks/machinery stock, la-
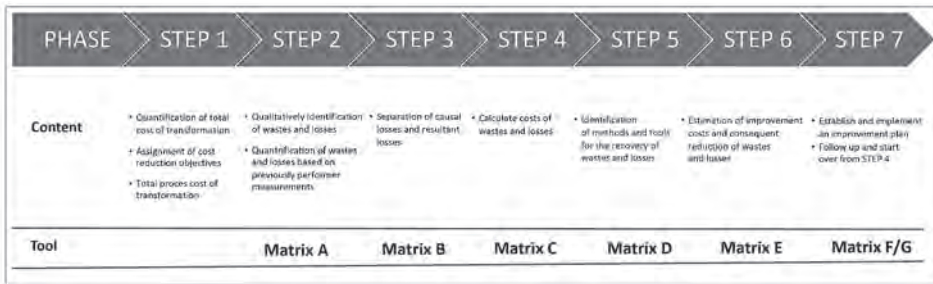
Figure 18.2. Cost Deployment Process

Source: (Preparatory materials for the Cost Deployment project of the analyzed enterprise 2016).

Table 18.2. Matrix example A – Loss and waste location

Source: (Materials created as a result of implementation works for the Cost Deployment project of a company, 2016).

bor, energy, materials used in production and internal transport and logistical aspects. Macro categories are subdivided into smaller areas depending on the types/areas of losses occurring within them, and then based on such a subdivision, the place where waste takes place can be indicated. The use of Visual Management techniques lets a company focus its immediate attention on the areas that require the most attention (Table 18.2).

After careful analysis it is possible to indicate areas of cost reduction, but without specifying the value of such reductions. The location of the losses in individual cost centers (Matrix A) is the starting point for further analyses.

Step 3. Identifying the Sources of Generated Losses – Matrix B

After classifying the generated losses within the production process, a business can move to the next level and create the so-called matrix B. The information that is "provided" as a result of the preparation of this matrix shows the correlation between individual loss items and cost centers. This matrix also takes into account the nature of the loss, namely whether it is a consequential loss or a causal loss. The ability and even more importantly the capability of indicating the nature of the loss (resulting / causal) has a direct impact on the resulting losses and avoiding their occurrence in the future. Moreover, the elimination or reduction of causal losses automatically affects the resulting losses without the need to act on them directly. The table below (Table 18.3) shows part of Matrix B which was created as a result of the work done in the workshop.

Table 18.3. Matrix B – indication of the cause-effect relationship of losses

Source: (Materials created as a result of implementation works for the Cost Deployment project of the analyzed company, 2016).

Often, the resulting loss is at the same time the cause of subsequent losses, therefore the capability and the ability to indicate the original loss is vitally important.

Step 4. Valorization – Matrix C

Transforming losses from a technical and technological point of view into monetary value is the next step in the Cost Deployment process. The unification of factors such as the period of time, scope of analysis and other data, is essential to ensure that the indicated values are consistent and allows a business to obtain homogeneity of results. This is done by calculating the costs incurred in individual activities that make up the indicated loss. Losses, which are expressed in technical values, are converted into monetary values, by using, for example, hourly rates or the cost of renting a square meter of a warehouse, etc. The analysis itself allows for a detailed allocation of losses to cost centers as well as to individual cost items so that the main areas of concern can be identified for future improvements. The data contained in matrix C (Table 18.4) are of great importance and are analyzed from three sides: cost, process phase and loss unit. Determining the significance of losses is often done using the Pareto method between the phase of the production process and the type and amount of losses.

Table 18.4. C matrix – quantification of individual losses

MATRIX C		Cost Centre	labour	indirect lab	energy	amortization	indirect materials	other VOH	scraps	stock–materials	stock-FG	TOT loss on transformation costs	Tot loss on components	Tot loss on tied up capital
										Stock – loss		TOTALS		
Equipment Breakdown	Breakdown failure	CdC A	XXX			XXXXX	X				X			
Breakdown	Breakdown failure	CdC B		0	XXX	XXXXX		XXX		XXXXX	0		0	
Breakdown	Setup Start/kill stop	CdC D		0		0	0		0	XXXXX		XXX	0	
Breakdown	Setup Start/kill stop	CdC E	0			0	X				XXX			
Performance	Microstops/il downtime	CdC A		0	XXX	0	X	XXX		XXXXX				XXX
Defects	Scraps	CdC D	X								X	X	0	XXX
Defects	Scraps	CdC A		XXXXX					XXX	XXXXX			0	
Labour Mngm&Organisation	Inefficiency	CdC D	X			0	X		XXX	XXXXX				
Mngm&Organisation	Inefficiency	CdC C	XXXX	XXXXX						XXXXX	X	X		
Motion loss	waiting time	CdC A				XXX	X	0		XXX	X			
Motion loss	waiting time	CdC D											0	
Motion loss	waiting time	CdC E			0								0	
Line support	Int. Logistic	CdC A		0			X							
Line support	Int. Logistic	CdC B		0										

Source: (Materials created as a result of implementation works for the Cost Deployment project of the analyzed enterprise, 2016).

Steps 5 and 6. Methods of reducing Losses and the Costs of Eliminating Them. Costs / Benefits – Corrective Projects. Matrices D/E

The data obtained as a result of the development of matrix C allow for the subsequent stratification of the components of losses, a step which is fundamental for identifying the root cause of the losses. Knowing and being aware of the

true cause of the losses allows a business to select the most appropriate tool and determine the proper approach to the planned repair projects. This facilitates the preparation of loss ranking based on loss categories and cost centers. It also allows for assigning estimated losses to individual technical pillars, and above all, it indicates the necessary methods and tools for their elimination. Matrix D is used for this purpose. While the information contained in matrix D is a presentation of an estimate of the value of individual loss categories and an estimate of the value that corrective actions will bring, matrix E is a comparison of the relationship between the cost generated by a given loss and the cost that should be incurred to eliminate it or limit its size. For each type of loss which was analyzed, the most appropriate corrective action is selected, which can be implemented under Lean Best Practices (Table 18.5).

Table 18.5. Indication of corrective methods and tools for individual loss categories

	Loss	Cost Center	Loss on transformation	Material losses	Short term savings	Medium term savings	I.C.E.	Lean Methodology and reduction tools	Implementation costs
Equipment									
Labor									
Materials									
Energy										
Logistics and space									

Source: (Preparatory materials for the Cost Deployment project of the analyzed enterprise 2016).

Making the appropriate adjustments to the corrective method, tools and levels of competence among staff working on the corrective actions should be subject to analysis and effectiveness assessment carried out with the entire management team of the company. All proposed activities are selected and assessed depending on three factors: impact, cost and ease of implementation. This so-called ICE analysis (impact / cost / ease) allows for the determination of an indicator which clearly shows the extent to which it is possible to reduce a given loss. The influence factor determines the value of the loss. The cost factor determines the value of the cost of introducing improvement measures for the indicated loss. The last of the three indicators concerning the ease of introducing the proposed improvements, shows a valuable approach to their implementation including the values of time and resources necessary to carry them out. Assigning each of these factors weights in the range 1–5 allows for objective quantification of the relationship of impact, cost and ease of introduction. The ICE index may

take values ranging from 1 to 125, and the higher its value, the higher the probability of the effectiveness of the corrective actions.

Step 7. Accounting for Actions Taken.

It is unreasonable to simultaneously introduce all approved corrective actions. Their timing is aimed at achieving maximum benefits due to their introduction. The sequence of individual projects is based on the results of the ICE analysis while taking into account management suggestions and decisions. Individual repair projects are analyzed from a financial point of view and by assessing the effectiveness of the investments. Certain indicators, such as PBP, NPV, IRR of the analyzed projects are compared to the company's internal financial framework guidelines. Cost is a resultant element, and the cause of its generation is waste. The selection of methods and the effects of their application are both subject to ongoing evaluation. According to the Deming scheme (Plan-Do-Check-Act), illustrating the basic principle of continuous improvement (continuous improvement, Kaizen), matrices F and G verify the implementation of assumptions and account for the actions taken. The F and G matrices are the final matrices in any given Cost Deployment cycle.

The Cost Deployment method allows a company to rationally and systematically set up a cost reduction program. An extremely important aspect here is synergy and joint action, as well as conducting analyses between production departments and controlling. Additionally, a globally applied approach shows that activities should be extended not to selected departments, but to all the departments involved in the production process. A graphic summary of the matrices used in the Cost Deployment process is shown in Figure 18.3.

4. Auxiliary Tools for the Cost Deployment Process

The use of IT tools including both databases and properly parameterized reports allows a company to obtain the information necessary for the cyclically repeated Cost Deployment process. Data availability enables and supports the company in its pursuit of a certain level of agility, as a combination of lean manufacturing efficiency with operational flexibility of modules, which in turn provides customized solutions (Sajdak, 2014; Dudek, 2019; Wodecka-Hyjek & Walczak, 2018)[2]. The use of such IT tools enables the Cost Deployment process

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[2] Customization is a philosophy of action based on the desire to create a product that is as fully compatible as possible with the individual expectations of the consumer (Szymkowiak, 2014, p. 934). There is a wealth of literature in the field of production customization and marketing, therefore the development of this topic in this paper has been omitted.
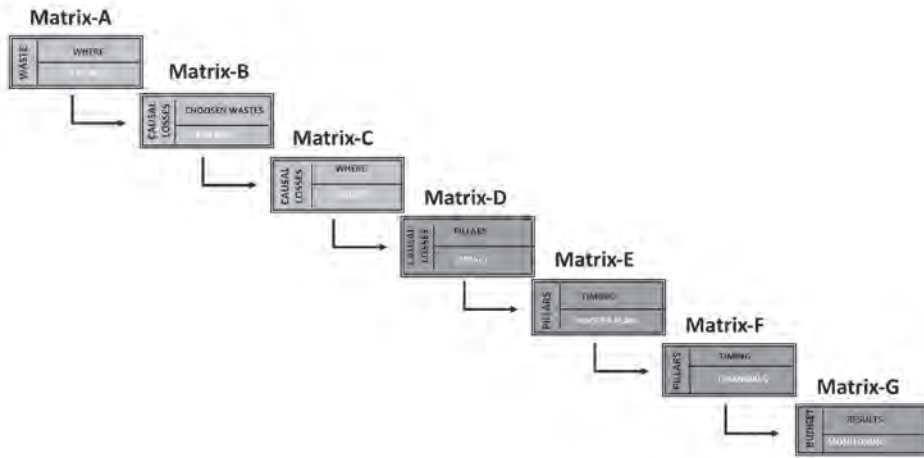
Figure 18.3. Matrix Sequence in the Cost Deployment process

Source: (Preparatory materials for the Cost Deployment project of the analyzed enterprise, 2016).

to be carried out. The use of appropriately adapted IT solutions results in the possibility of structural and multifaceted data analysis. Such an analysis leads to a holistic approach to the area being analyzed, which is crucial for achieving the goals set for the organization and it also allows for flexibility of activities, which is the basis of the agility of the company.

Supporting tools in the implementation of Cost Deployment include not only IT tools based on data analysis, but also techniques serving and supporting the WCM implementation process in the enterprise (DeBusk, 2012). A commonly used tool in Lean Manufacturing is VSM (Value Stream Mapping). It is a comprehensive analysis and visualization tool to illustrate major processes and their operations, along with lead times, buffers, and information flows (Rother & Shook, 2003). VSM is perhaps the lean tool that has received the most attention over the years, both in terms of evolution and adaptation. The works of Khaswala and Irani (2001), Braglia, Carmignani, and Zammori (2006) and Matt (2014) present possible variants or integrations of the original VSM technique that was developed after implementing Lean applications in various environments.

5. Conclusions

The Cost Deployment approach presented here is a method mainly used in enterprises participating in the WCM process. Preliminary studies show, however, that it can be used in those units that intend to introduce at least the core principles of Lean management in the enterprise, and are concerned about satis-

fying customer needs through continuous improvement and the elimination of waste (Kaplan, 1983; Grasso, 2005). Therefore, Cost Deployment, with appropriate simplifications, can be successfully applied in enterprises with a lower level of organization, enabling them to achieve cost efficiency while maintaining a certain flexibility of processes which is characteristic of less structured production enterprises.

The Cost Deployment method can be a kind of path that a company can follow in search of the ideal cost of production. Of course, the best solution is to implement a personalized system, but it is quite an expensive undertaking. The main task of modern measurement and evaluation methods is not to control, but to communicate the current situation and set goals to be implemented in line with the strategic goals of the company. There is a need to search for modern business management tools to improve the efficiency and effectiveness of management (Nesterak, 2015). The use of the Cost Deployment method as a cost analysis tool may support management in making effective business and strategic decisions, and consequently it could be helpful in creating a competitive advantage by improving production processes, as well as increasing the ability and flexibility to react quickly to changes. Thanks to the use of Cost Deployment, the company can direct the activities that it undertakes in order to achieve the company's competitive advantage and above-average business results. Developing and personalizing the cost analysis serves the most effective use of resources, which has a significant impact on the strategic advantage achieved in subsequent periods.

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An Effective Information Flow System as a Factor of the Growth of Dynamics in the Development of SMEs. An Empirical Example of Company "X"[1]

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1. Introduction

The contemporary economy is understood as a knowledge-based economy, with its digital character as a favourable element (Grabowski & Zając, 2009). The present form of economy from the global perspective is a consequence of the consecutive industrial revolutions, revolution 4.0 included. The essence of the economy thus approached can be defined with regard to nine basic technological trends which are becoming part of the everyday economic life of organisations: autonomous robots, simulation, horizontal and vertical system integration, Internet of things, cybersecurity, the cloud, additive manufacturing, augmented reality, big data and analytics. In each of the trends, an important element are data, or more broadly – information which, with appropriate assumptions and in proper conditions, is transformed into knowledge. However, as detailed analyses show, few world economies can be regarded typical knowledge-based economies. Considering the fact that the economy as a whole consists of specific parts, among which, looking from the economic and financial point of view, an important component is the sector of enterprises, the development of exactly this sector is significant for its development, including the growth of GDP. In the economy of the European Union within the sector of enterprises the fundamental significance of the small and medium-sized enterprise sector is indicated, as the sector has a considerable share in the overall number of non-financial entities in the GDP creation and in employment (Borowiecki *et al.*, 2018). The above arguments

were the reason for which the authors of the paper became interested in entities belonging to the SME sector.

It should be noted that research into the information flow system in small and medium-sized enterprises in the context of the growth of their development dynamics is one of difficult areas of scientific analyses, which is related to not very positive attitude of entrepreneurs themselves to sharing information about systems implemented in their entities, which are defined as strategic assets in the aspect of the contemporary knowledge-based economy (Choo, 1996 & Siuta-Tokarska, 2016).

The adopted aim of the publication was to present the use and management of information flow in SMEs, based on the own qualitative research conducted in the form of an interview with the owner of a small enterprise in Poland conducting construction activity (a case study). The following research questions were posed in the paper:

1. What relationships occur between data sets, information and knowledge in firms?
2. Can the information flow system contribute to the growth in the development dynamics of an enterprise included in the SME sector and if it can in what way does it do it?

The added value of this article is particularly related to its empirical layer referring to the presented case study of a small firm in the form of a limited liability company, conducting activity in the construction section – as an example of growth of dynamics in a development process with the analysis of its factors.

2. Information and SMEs

Contemporary communication forms provide unlimited possibilities to exchange information (Golka, 2005). Undoubtedly, the creation and development of the Internet has become the main source of the dynamic growth of the significance of information. The role of the Internet is increasing dynamically, the more so that it is an area included in the European Commission programme "A Strategy for Smart, Sustainable and Inclusive Growth" conducted within the strategy of economic reforms outlined in the document entitled "Europe 2020" and aiming to contribute to build a smart and sustainable economy, favouring social inclusion.

The growth of information importance is visible through the scale of pressure on its development (Hejduk, 2018). Governments of individual countries and the European Union as a whole implement still new programmes forcing citizens to use new technologies.

Contemporary man is not able to resist forces shaped through mutual influence of technologies, economy or culture. However, common access to information and its almost unlimited amount does not mean "increasing" knowledge. It is the excess of information which is a problem, the excess which has no ordered structure and causes uncertainty in a receiver as for its proper interpretation. There are not unambiguous sources indicating the reliability of information and problems occur when trying to establish the proper version. Paradoxically, an increase in the amount of information provided leads to considerable extension of the time of reaction due to the necessity to analyse the correctness of data and taking the right decision (Maruping & Matook, 2020).

The development of information society has its positive and negative effects. State borders have been abolished, language barriers have been liquidated, numerous professions have been moved "home" and social contacts have been moved to digital platforms, losing the capabilities of non-verbal communication because of that. With technological development, the privacy of an individual is lost. Positioning devices on the one hand cause opposition against growing surveillance, and on the other hand strengthen the sense of safety in the case of fortuitous events. As a result, a popular saying that: "Whoever has money has the power" has changed under the influence of the transformations into: "Whoever has information, has the power and money".

Research and deliberations conducted by scientists on a country and its citizens' belonging to so-called "information society" has been to some extent decided by the global pandemic of COVID-19. Actually, no-one should doubt any more that the era of information society has become a fact. Entrepreneurs are trying to outdo each other in creating new needs for society, diversifying their own business activity. It is an effective method, preventing the bankruptcy of firms. Such activities are mainly conducted by entrepreneurs who have developed the agility of their firms over the years, and the specific character of their activity is flexible enough to adapt promptly to the surrounding reality. It should be noted that in the legal aspect, an enterprise is considered to be an entity conducting economic activity regardless of its legal form.

In Poland, the growth of interest in IT technology and indicating the directions of development were related to the obligation imposed by the Act on Social Insurance System of 13 October 1998, obliging entrepreneurs since 2001 to submit insurance documents in the electronic form by means of a computer and software compliant with the requirements provided by the documentation attached to the IT programme, the Internet, and the obligations for payers of contributions submitting insurance documents in the electronic form to have an electronic mail address. At that time, HR and payroll software used particularly in small firms operated mainly in DOS system. The requirement to use the

Płatnik software, operated only in the Windows version, forced contribution payers to buy separate computers with Windows 95/98. The legislator introduced the electronic communication obligation many times but limited itself to define the structure of swap files.

The growth of interest in IT technologies in the SME sector was not rapid (Stefanowicz, 2013). It was a result of numerous factors, and the main one was the fear of the new technology, no trust in the operation of the application, limited functionalities of the software, lack of IT support, high costs of hardware or the reluctance to break the routine activities. The beginning of the 21st century, with the unstable labour market and gradually increasing unemployment rate in Poland, determined employees to acquire knowledge in new technologies, mainly because of the fear of losing a job.

The costs of investments in new technologies and the scope of their application have become the determinant stimulating specific actions of entrepreneurs. It is widely accepted to write and speak about small and medium-sized enterprises as if it were a group of homogenous firms, whereas business entities included in this sector differ substantially and in various respects:

1. In this group, there are enterprises representing all organisational and legal forms permitted by the regulations of law (Bielawska, 2009).

2. Innovative potential in an organisation means the level of propensity to win and implement innovation. In the case of small and medium-sized enterprises, it is their owners or managers who are forced to search for external sources of increasing this potential (Borowiecki *et al.,* 2018).

3. Information cleaned from noise and chaos, and provided within a specified time is a strategic asset of an organisation (Gołąb-Kobylińska, 2018). Available technologies support the processes of collecting and processing information, but the strategic role in the process of managing the possessed assets is played by the human factor. In the SME sector, there is a shortage of tools to keep high class specialists, as they usually have holistic knowledge about processes undergoing in the organisation, and their departure means a long-term adaptation process of another specialist.

4. In an extended organisational structure, the process of sharing knowledge does not run in a natural way, either, as it is a strategic factor of the development of a firm owing to which it becomes valuable and which results in a desired promotion in the hierarchy of the organisation (Wydro, 2007).

5. With regard to information flow in an enterprise, specific differences among the SME sector entities are indicated (Dyczkowski & Dyczkowska, 2015). It should be emphasised, however, that the SME status is not an exclusive classifier indicating the scope of regulations concerning entrepreneurs on the

grounds of both the EU and the national law. The GDPR Regulation (General Data Protection Regulation) introduces the obligation to appoint a Data Protection Inspector, conditioned by the character of the man activity, the type of data processed, as well as the determination whether a given organisation is a public organ or body. The same regulation conditions the necessity to keep the register of actions of processing personal data and the register of all categories of processing activities performed on behalf of the administrator, excluding from it an entrepreneur or an entity employing fewer than 250 people, unless the processing may cause the risk of infringing the rights or freedoms of people the data concern, is not occasional or includes special categories of personal data or personal data concerning judgment of conviction and a prohibited act.

Analyses and scientific research point out that information in 21st century enterprises is a strategic asset. However, proper flow and management of this asset is not an easy task and requires specific skills and knowledge from entrepreneurs/managers. What is characteristic for SMEs is the flexibility of action, triggering initiative and creativity, creating horizontal and vertical integration and cooperation links, which in the context of permanent changes in the environment seem extremely important, allowing them not only to survive but also to develop. However, linking the problem of information, its flow in a firm to changeability of the environment, we can note a research gap concerning the relationship between the information flow effectiveness and the dynamics growth in the development of SMEs. Therefore, attention should be paid to the need of conducting qualitative research in small and medium-sized business entities into this problem, which will enable the occurring relationships and dependencies to be revealed. Conducting such research based on a case study is an answer to the revealed need to fill the before mentioned gap.

3. Information Flow in a Small Construction Company and its Significance for the Development of an Organisation – a Case Study

The existence of a problem which is the need to create an effective system of information flow in order to increase the dynamics in SMEs is presented and described based on qualitative research conducted in the form of a structured interview in a small construction company[2] ([1]).

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[2] The presented deliberations are only a fragment of more extensive research concerned with broad aspects of managing information in SMEs.

The research was conducted in the fourth quarter 2020 in a service firm whose core activity concerns the construction section. "Company X" is included in the group of small business entities. The research was done based on an interview and statistical data published for entities of this sector. Because of the communication restrictions and the concern to minimise the risk caused by COVID-19 pandemic, the interview was made with the use of means of direct communication in the form of a videoconference. The research concerned the scope of the information processes depending on the environment, its distribution method and the analysis of the role it plays in the company development process.

In the context of the present situation connected with Covid-19 pandemic restrictions, the economic situation of countries is under constant supervision, with special consideration to the area of companies' activities. The condition of individual sectors is assessed, on the basis of which potential service recipients are predicted. It takes place through constant supervision of planned investments and a possibility to submit own offers. The studied firm does not limit itself to offering services on the local market only. In the case of distant jobs done by the studied entity, the labour market and the possibility to find seasonal workers are analysed. Company X also implements long-term investments, however, submitting an offer is preceded by the analysis of the condition not only of a given company itself but also other statistical ratios based on which the risk of the implementation of a given project can be assessed.

In spite of resilient activity of the firm and undertaking the execution of new orders in the first period of the pandemic, as early as in the 2nd quarter 2020, problems started to arise, related to the absenteeism of workforce. Then the rotation work system was implemented, excluding alternately part of teams. Office workers were delegated to work from home. For many years, in concluded contracts for service provision, the company has used a clause that the parties shall not bear any responsibility for failure to perform or for improper performance of the contract caused by force majeure. It means that in the event of the occurrence of force majeure, the contract is still in force but Company X is not obliged to pay compensation or a contractual penalty. The lack of the possibility to meet deadlines for the execution of orders, in spite of the fact that it is not burdened with contractual penalties, causes the prolongation of the dates of gaining financial earning. One of the positions which most encumbers Company X financially is the payment of remuneration. Undoubtedly, the government support which the company obtained allowed the firm to retain workplaces. The company covers on-going costs but this is mainly owing to the capital accumulated from financial surpluses in previous periods. The firm has not experienced a drop in the num-

ber of orders, but their timely execution is questionable, and thus there is a visible necessity to verify concluded contracts and adjust them to the changeable socio-economic situation, considering the risk of the occurrence of unexpected changes, independent of the company, including legal, sanitary ones and others.

After a careful analysis of advantages and disadvantages of available legal forms of conducting business activities, the founder decided to register a single-person limited liability company. In a single-person company, the sole partner exercises all rights the shareholders' meeting is entitled to.

Company X, functioning for many years, has developed a functional management structure. It was not preceded by analyses, and is only a response to on-going demand of both the internal and external structure. The company employs 48 workers. Duties and responsibilities were assigned to 5 organisational units and one independent position. The organisational structure includes: Head Office (3 people), Project Management Department (11 people), Contractor Services Department (24 people), Accounts and HR Department (5 people), Purchasing and Materials Management Department (3 people), Independent OHS position (1 person). For managers of the organisational units duties and responsibilities were defined. In the Contract Services Department there are 6 separate teams managed by foremen.

The company concluded contracts for legal and IT services with external entities.

Over the years, Company X did not conduct the rotation of the staff and the initially assigned scope of duties has not changed over the whole employment period. The workers do not have holistic knowledge about the process in which they only perform a limited scope of duties. There is no uniform information flow in the company. It is implemented habitually. Information about the external environment is monitored by each of the managers according to their own interests.

The specific character of the company activity is related to the seasonality of providing the services. The company planned to solve the problem through horizontal diversification, launching onto the market services connected with the preparatory stage of investment implementation, which can be performed regardless of the season of the year, as well as through the engagement of the human capital in equipment renovation works and the extension to their own technical facilities. The decision about the development of the catalogue of services, introduced a few years ago, aroused a lot of interest among investors, which resulted in the growth of capital expenditures, mainly through an increase in the number of workforce in the department, and investment in appropriate software and equipment. For legal reasons and because of need-to-know requirements, the service cannot be an alternative for workers implementing field tasks, therefore,

it is only the financial security for the company in the season of lower activity caused by the specificity of the conducted activity. The problem of seasonality is also partly solved by investing in specialist equipment, adopted to work in different weather conditions. Limitations in the continuity of work result from extreme temperatures, however, such situations have been rare recently.

With regard to the management staff and non-manual workers, Company X marks the stability of employment, which is a great advantage as for the possessed experience, regardless of the formal preparation and necessary education of workforce. It should be emphasised that the majority of employees' activities can be included in the sphere of tacit knowledge. For 5 years, the company has experienced cases of best qualified members of middle and upper management reaching retirement age. Due to satisfactory pay and interpersonal relations in the company, employees have not left the employer. However, the situation may change soon, mainly because of the specificity of the job which requires physical fitness. Therefore, the firm has opened its labour market to potential replacements, assuming that qualifications acquired in another workplace or at school are not sufficient to maintain the present quality of services in the company. Recent months have considerably changed the situation on the labour market, but the expectations of the company as to the level of knowledge, qualifications, abilities to adapt to the work environment, as well as the ability to work in a team have not changed. As a result, in the HR area it will be necessary to carry out another recruitment enabling the company to find workers who would like to create a bond with the company as a long-term employer.

Legal services provided to Company X are in the form of an order for an external law office. However, they concern only enquiries made by the company or representation prescribed by the law. Monitoring of changes in regulations must be done by the company. Taking into consideration current dynamics of changes in legislation, their ambiguity, incoherence and lack of stability caused by the Covid-19 pandemic, uncertainty is growing, both as to fulfilling the mandatory regulations of law and apprehension of not using offered governmental financial support from this or that fund, e.g. EU one. The company has increased the range of duties for each manager by adding to them monitoring of changes in regulations. Yet, there is no central system of collection of data and information important for the company and its further internal distribution.

As regards fulfilling obligations arising from personal data protection regulations, substantial support for the personal data administrator was defined in duties and responsibilities of the Head Office Manager. The IT infrastructure is only in the administration office. The server room is not a separate area, and the equipment playing the function of a server is in one of the rooms used by

the Head Office. Each of the office workers has a stationary computer, whereas foremen working out of the office have tablets with Internet access. IT services are provided by an external entity on a contractual basis. Its subject is managing the computer network, hardware repairs, implementation and supervision of the software functioning in the company, with special consideration to its implementation, substantive assistance for the staff, licence management and data archiving.

With regard to the security of information, its flow in the company, it should be noted that Company X employees have knowledge about the value of the possessed information but they cannot evaluate it. Data loss is perceived by the workforce as time necessary to restore it. The set of information in the studied entity is decentralised and has various forms, both paper and electronic. Quite often materials are duplicated and there are problems with establishing current versions.

The specific character of work and lack of discipline with regard to immediate update of stock level data leads to excessive purchases or not maintaining minimum levels of strategic materials. The organisation is equipped with shredders and the procedures of destroying documents have been implemented. There is an excess of collected data in the company, which results from a fear of failing to prove the fulfilment of legal obligations to inspection bodies. The excess takes place mainly in HR data and accounting documents. Financial and accounting, HR, warehouse modules, as well as electronic Lodgement of Documents function in Company X. These are separate modules implemented in various periods and coming from different producers, but their integration is not cost-effective. In its investment plan for 2020, the company considered the implementation of an integrated IT system, integrating currently functioning subjective scopes of the modules, as well as the inclusion of new areas, such as fixed assets, document circulation, transport, public procurement. Due to the pandemic and uncertainty about the financial situation of the company, the decision about the implementation of the integrated IT system has been withheld. The company is searching for co-financing sources to do that. The main reason for the decision about the purchase of an integrated IT system was the discontinuity of support and development by the producer of the existing financial and accounting software in the entity.

Gradually, with the purchase of computers for the company, also office applications, such as OEM, were bought. The organisation has also software for 2D/3D designing, supporting the process which is the subject of the services provided.

Internet access is provided by a local provider of telecommunication services via a fibre-optic access circuit. The organisation has its own domain whose

name unambiguously indicates the owner, whereas on the hosting the company bought data are collected in the form of a website and e-mail accounts.

For two years, there has been electronic registration of incoming and outcoming documents in the company. The record is kept on an ongoing basis. Data concerning the matter description, the counterparty's code, information about the person responsible for the realisation of the matter, the deadline for the closure of the matter. The entry date and the number are completed automatically. The software can assign appropriate roles and authorisations.

Computers have anti-virus protection, but there is no protection against unauthorised installation of unknown software coming from the Internet, such as freeware. The mechanism of automatic backup is applied only to the server resources, financial-accounting, HR and warehouse applications. Data archiving takes place monthly and they are stored on a separate medium. Data created on computer stands are not archived. In the case of servicing or repairs of hardware, discs are not protected. Applications are installed on the server and access to them is not possible outside the local network, but the employees have reports, statements and letters on their computers which are generated with their use. The personnel have individual and departmental e-mail accounts, at the same time they use their private e-mails in correspondence with their counterparts. There is no training or instructions forbidding staff to open attachments in the electronic mail.

4. Conclusions and Recommendations

Conducting theoretical and empirical research into the effectiveness of the information flow in SMEs as a factor of the growth of their development dynamics enabled the authors to obtain answers to the research questions posed in the Introduction of the paper.

Re 1) What relationships occur between data sets, information and knowledge in enterprises?

In spite of the proven poorly structured communication between the departments in Company X, the experience of long-time workers and the leadership skills of top managers enable maintenance of the firm in a very good financial standing. In the era of the Covid-19 pandemic, nervousness has appeared in the relationships among the staff, mainly caused by excessive assignment of jobs to individuals due to high absenteeism. The HR policy of the company and omissions in the processes of knowledge sharing have led to staff shortages in the strategic areas of the entity, which is the consequence of the unexpected, high level of absenteeism.

No uniform flow of information for the whole organisation as to the monitoring of the external environment has been introduced in Company X, as a result of which omissions related to wrong addressing of contents potentially important to the company took place, when they were rejected by workers unfamiliar with activities of another organisational unit.

Trust which long-time employees place in each other has caused omissions in information processing protection. There are visible gaps in employees' knowledge about personal data protection and there is no person supervising the whole process of information management.

Paradoxically, the Covid-19 pandemic forced the company to on board employees on duties and responsibilities previously unknown to them immediately, allowed them to gain a holistic view of the process of the whole business. The new view of the activities taking place in the organisation, as well as the need for simultaneity of activities motivated the personnel to share knowledge which, enriched with new elements, gives measurable benefits.

Re 2) Can the information flow system contribute to the growth of dynamics in the development of enterprises included in the SME sector and how can it do so?

Human capital, its experience, skills and knowledge are a measure of a company's success. Nowadays, its proper use is not possible without the support of modern technologies. Information, which is the source of knowledge, must be provided in a proper form, in a specific scope and at the appropriate time. Unbelievable amounts of information available on the Internet, without proper selection methods simply lead to destructive information chaos. Useful information must be objective, significant, exact, homogenous, important, available, up to date, reliable, complete, unambiguous, processable, repetitive. The catalogue of traits information must have never ends. Every organisation has its own strategy and an aim it strives for. Based on the conducted qualitative research in the form of an interview in an enterprise belonging to the SME sector, it has been proven that there is a relationship between an effective information flow system in an enterprise and the growth of its dynamics in its development. An analysis of the literature of the subject, as well as the conducted research, including specialist trade journals, also reveal the emerging need for support of this area of activity in small and medium-sized enterprises, which during the Covid-19 pandemic seems to be binding for their survival and further development. A properly tailored information flow system, which is indicated as a strategic asset of a firm, may determine the competitive advantage of businesses in the era of the pandemic. Appropriately directed EU funds within that scope can be an important factor on the way to combating the crisis in the SME sector.

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Evaluation of the Effectiveness of Netting in an International Enterprise's Practice[1]

Magdalena Belniak

1. Introduction

Internationalization offers numerous advantages, however, functioning in the global market is a big challenge for enterprises and presents many issues such as complicated and expensive international settlements. Fortunately, financial institutions which create instruments and tools aimed at supporting complex transactions are there to help fight obstacles. One of the solutions gaining global popularity is netting – a tool supporting international settlements of enterprises, consisting in mutual offsetting of liabilities and receivables between economic entities. Due to its specific business profile and rapid growth, the enterprise subject to examination quickly became internationally active. Dynamic development and international expansion of products offered opportunities to set up branches in other countries, resulting in an increasing number of international transactions in various currencies. In order to lower the transfer transaction costs, the company began to search for improvements. The aim of the presented article is to evaluate the effectiveness of the netting system in an enterprise operating internationally.

2. The netting History in the "XYZ" Capital Group

Netting was first used in the XYZ international enterprise in the mid-1970s, but the form which it originally took was significantly different from the one used today. Mutual compensation concerned entities belonging to the international enterprise. The companies were linked to one another in an electronic e-mail

system, thanks to which they were able, on an ongoing basis, to send information about balances and liabilities, and mutual payments. Payments were settled locally and the entire netting system was coordinated by the Geneva branch. In 1980, included in intra-group netting payments was a small proportion of payments to suppliers. In 1998, the company transferred coordination of the entire multilateral netting process to its London office. Thanks to close cooperation with one of the largest British banks, more than 30% of payments to suppliers were included in the netting system. In 1992, the system was able to automatically generate statements containing information for suppliers. Thanks to multilateral netting, both the total value of corporate transfers and value of international futures contracts increased along with the growth of entities participating in the netting process.

The current form of netting was implemented in 1993. Employed for this purpose was a global system of cross-compensation, which was able to manage foreign settlements between the company's branches and settlements with external suppliers. At that time, the popular six sigma method was used, with a view to reducing probability of defects while increasing the process stability. The six sigma method was a success, and the volume of transactions grew in line with the dynamically developing enterprise. Since then, the number and value of both external and internal transactions has been increasing.

2015 saw a breakthrough for the company and automatic settlement of payments. The company implemented a new netting platform coordinated by an external company. The platform contained a database of all group branches and suppliers, and all issues with payments were controlled thereby. The company currently has over 90 netting units. The use of netting has also been extended to the provision of funds to cover liabilities to subsidiaries in need in every possible currency. Netting is also a tool facilitating transfer of dividends and loans between group entities.

2. The netting Mechanism in the XYZ Corporation

Netting is now an inseparable and key tool for settling payments in the company in question. In the economic market, the most common solution is to use netting one time per month. However, the analyzed group, due to the large number of external settlements, performs this process once a week.

There are five groups of entities participating in the cross-compensation process of the XYZ international enterprise;

■ subsidiaries of the corporation (90 branches – due to legal restrictions),

- ATC centre (Accounting Team China) aimed at regulating external obligations of individual companies and reconciliation from accounts from which payments are made,
- the treasury department, responsible for conducting and coordinating all netting and currency exchange performed by employees with banks operating on the stock exchange in order to obtain the best rate,
- an internal netting centre designed to settle all payments,
- banks acting as intermediaries in payments from suppliers, as well as intergroup payments and currency exchange.
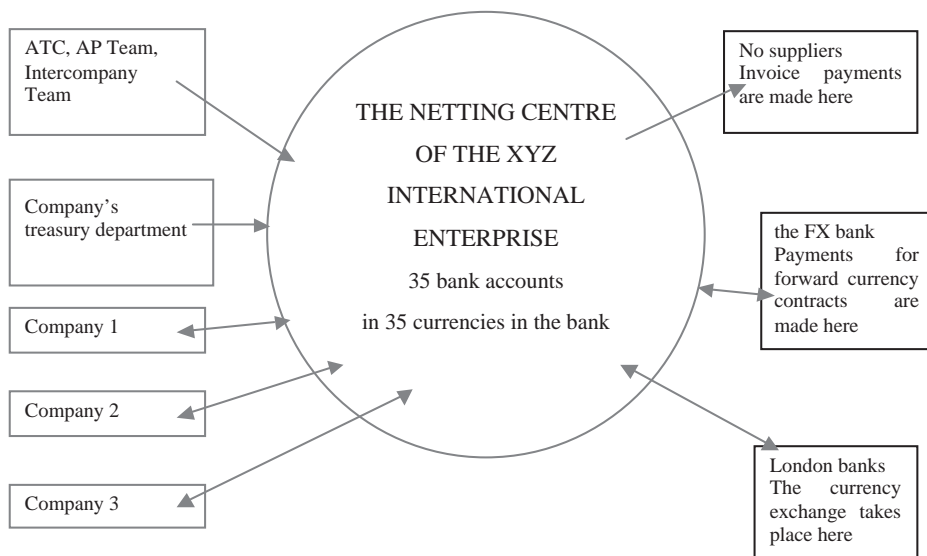   The netting process taking place in the enterprise is shown in Figure 20.1.

Figure 20.1. The netting process of the XYZ corporation
Source: own study based on internal data of the XYZ corporation.

The key issue is the netting centre itself, operating as a platform handled by an external company. The task of individual departments is to enter specific data, information, payments, or invoices. Each company can also replenish funds among themselves and request the currency that it needs in a given week or offer the currency that it does not need. When necessary, intra-unit loans or deposits are granted and handled by the netting centre. The task of the treasury is to enter all expiring SWAP contracts. In practice, this means that XYZ Company buys a certain amount of a given currency at a certain rate and on the same day sets the selling price of the same amount of currency after e.g. 3 months to hedge against the risk of currency price fluctuations.

The above-mentioned activities must be performed on the first days of the cycle (day 1–2), on the third day the netting platform is blocked for all process participants. The netting centre, having received all payment data, generates a report determining the net positions for all branches involved in the settlement; at the same time, it determines currency positions that must be sold or bought. Each unit has liabilities or receivables present in the settlement. currencies other than local or settlement currencies (in Poland, XYZ companies keep their books in USD). An important aspect is the fact that payments with suppliers may be settled in two ways – paid in the currency of the entity accepting the invoice or in the currency of the entity issuing the invoice. The international enterprise in question uses the second method. Any group items occurring in a given week are converted into USD.

The third day of the netting cycle in the company is the most intense and important for the entire process. The netting platform is closed to other participants, only the vault department has access thereto. Based on previously entered transactions, a report with currency positions is generated. The system also introduces average buying and selling rates in relation to USD, valid on a given day. Employees are then able to know the approximate value of transactions in foreign currencies, which is also necessary when negotiating with the bank. Negotiations take place with two banks at the same time.

The foreign exchange market offers two forms of transactions – forward and current ones. Futures, forwards, and options involve the sale or purchase of currency in the future. However, in netting, the company relies on spot current contracts, which require the exact price to be set at the time of the transaction and is usually delivered after two business days. Therefore, all money transfers, internal and external, are made with a two-day delay from the date of the exchange transaction. Another obstacle in settlements are the so-called currency vacation. Such situations occur when a country participating in the netting settlement has a national holiday at maturity. Then the billing period is delayed by the following business day or the nearest possible date.

Day five is the last day of the netting cycle. All netting transactions are regulated, both intra-group and all obligations towards suppliers. Here, the main role is played by netting accounts to which all payments from entities within the group and from other banks (payments resulting from foreign exchange or long-term contracts) come. At the same time, payments are made from netting accounts to banks, suppliers and other entities. Thus, the balance after payment of all liabilities is 0.

3. Threats Occurring During Settlement of Netting Transactions in the Examined Corporation

Common errors made by entities responsible for transfers of funds on behalf of branches are:

- transfers of funds which do not cover liabilities – entities transfer too small amounts to the netting centre, mainly due to misreading of the netting report or an error made whilst entering the amount. This phenomenon is particularly unfavourable for the netting centre, as the company has to cover penalty negative interest from own resources;
- transfer of funds exceeding liabilities – branches transfer excessive amounts to the netting centre, also by mistake; this phenomenon is not as negative as the previous one, however, it generates additional work and transaction costs (the excess amount must be transferred back to the account of the branch).
- untimely payment of receivables – a very common phenomenon occurring almost in every netting cycle. The person responsible for making the transfer to the netting centre is to blame, however, delays are most often related to legal regulations;
- splitting liabilities into several transfers – similar to the previous item; some countries have legal regulations disallowing foreign transfers of funds exceeding a certain amount, and such transfers are charged with high transaction costs. To avoid such, the entity divides transfers into several smaller ones, but the bank of the netting centre experiences difficulties combining several smaller transfers up to the originally expected amount.

4. Assessment of Effectiveness of Application of the Multilateral Compensation Tool in the XYZ International Enterprise

The following assessment concerns strengths and weaknesses of application of the multilateral compensation tool in the corporation in question. In the case of analysis of low efficiency of netting, the most important issue are legal regulations regarding the use of netting in a corporation. This process required significant outlays of work and time, associated with high costs. An additional disadvantage was that not all branches of the company managed to apply netting (e.g. Korean or Pakistani branches). Therefore, this type of international settlements is not fully effective for the company.

Netting also appears to be significantly less effective when the company's financial standing has been impaired. For the XYZ company, most of its overall

trade consists in international internal exchange between entities. Oftentimes, some companies experience financial difficulties and are unable to settle their liabilities towards other entities.

The key factor prompting the audited company to implement the netting system is savings. Thanks to the use of multilateral compensation, these are obtained several times. First of all, the volume of transactions decreases from thousands of transfers that would have to be made manually by branches to several dozen performer collectively by the netting centre. As a result, the company is able to reduce transaction costs by up to 88%.

Another saving is the collective currency exchange, and thus reduction in the currency risk. By collecting all payments in foreign currencies other than local currency for a given entity, the company is able to realise economies of scale. When selling or buying currencies, the bank offers a much better price for high positions (the monthly value of all currency positions reaches up to USD 120 million). Individual entities would obtain less advantageous currency exchanges. By structuring the process of foreign settlements by the netting centre, various types of bank charges are also reduced, thus generating further savings.

The benefits of netting for a company are beyond any dispute. The entire process of international settlements has become much simpler. Each employee responsible for a branch's transfers or their replenishment can use the platform by adapting to the netting cycle and fixed time frames. Netting significantly simplifies any analysis of the flow of funds at the turn of the month, quarter, or several years. The data is collected in one place and is publicly available. The company's accountants easily book the performed transactions on the basis of reports automatically sent thereto directly from the netting platform. For the treasury department, this type of settlement means a much lower number of accounts and interactions with banks.

5. Conclusion

In recent years, international businesses have focused on the benefits in efficiency of the intercompany settlement process that are offered by a netting system. Channeling all intercompany invoices through a single hub using data interfaces to and from each entity's ERP or local accounting system ensures consistency and accuracy in the data, as well as enforcing a standard settlement structure to make sure invoices are settled promptly.

Aware of the dynamic development of the financial market, caused chiefly by globalization, the XYZ international enterprise decided to introduce an innovative method of international settlements. In spite of numerous negative prem-

ises and a significant risk of using the netting tool, its overall effects are extremely effective for the company. Thanks to a well-thought-out implementation strategy, appropriate securing, risk minimization, and frequent training of the company's employees, the netting process was successfully implemented and showed a positive balance of benefits. The netting system reduced the overall foreign exchange volume traded and cut the amount of foreign exchange spread paid by the company to manage all the currency conversions. The system mechanisms significantly facilitated the settlement process and centralized the company's financial management. This, in turn, positively influenced development and operational management of the enterprise.

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The Essence of Contextual Competences in Project Management[1]

Małgorzata Zakrzewska, Paweł Cabała

1. Introduction

Dynamically changing economic and environment influence the growing importance of projects and project management in organizations. Today, project management is an essential aspect of management in all types of activity, for example in administration, non-profit organizations, healthcare and industry. Elia et. al (2020) claim that environmental factors such as stakeholder's engagement, technological development and sustainability requirements increasingly influence the complexity of project management.

Project management can be understood in two ways. Firstly, it can be defined as the field of the theoretical and practical knowledge which is used in management, but also it can indicate a set of managerial skills that are necessary for the effective implementation of projects (Trocki, 2012). Project manager's certification institutes define project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (PMI, 2017), "the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters" (APM, 2019) and "the planning, delegating, monitoring and control of all aspects of the project, and the motivation of those involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits and risk" (AXELOS, 2017).

Even though project management definitions are different and more or less complex, an important element connecting all definitions is the application of

knowledge, skills and competences. The role of project managers' competences is becoming more and more important, which is why many studies are undertaken to present the sets of competences necessary for proper project management. One of the key publications in this area is the Individual Competence Baseline for Project Management (2015) developed by the International Project Management Association (IPMA), in which individual competences are defined as „the application of knowledge, skills and abilities in order to achieve the desired results". IPMA ICB 4.0 presents 28 competences for project management divided into the following three sets: perspective competences (5 elements), people competences (10 elements) and practice competences (13 elements). Perspective competences refer to the methods of cooperation between projects and the environment, people competences are personal skills and behavioral competences, and practice competences present the tools and techniques used in projects.

Considering the growing importance of environmental analysis and stakeholder involvement in projects, contextual competences are a very important area of project managers' personal and professional development. The main purpose of this chapter is to provide the definition of the contextual competence elements and their measures that have been proposed by the international certification body IPMA. This chapter reviews the literature in the field of project management describing the essence of contextual competences. The last part of the article presents the results of empirical research conducted among Project Management Professionals in terms of the level of competence of project managers. In this paper, the authors use the terms of contextual and perspective competences interchangeably. This is due to the fact that the IPMA ICB 4.0 competency model presents contextual competences in a set called Perspective.

2. Literature Review

2.1. General Meaning of Competences

Based on the considerations of Delamare Le Deist and Winterton (2005) and Wesselink et al. (2010), Lambrechts et al. (2019) claims that competencies create clusters of skills and elements of knowledge that enable a manager to perform work effectively.

In the sciences of organization and management, employee skills have always been of particular importance, as they enable the achievement of set goals and the achievement of planned results. Both changes in the economic environment and in the ways of managing organizations prompts the need to identify the sources of the desired employee behavior which are generally described as "skills" or "competences". There have been many attempts to define the relationship be-

tween skills and competences, but it has not been clearly defined. The literature on the subject emphasizes many times that skills are an integral part of the definition of competences.

Moreover, the review of the definition of competences allows distinguishing two more components of this term: knowledge and attitudes (Spencer, Spencer, 1993 & Kossowska, Sołtysińska, 2002). In Table 21.1 below reviewed definitions of the concept of competences were compared.

Table 21.1. Comparison of the definition of competences and their main components

Definition	Main components
A set of features of a given person, which consists of elements characteristic for this person, such as motivation, personality traits, skills, self-esteem related to functioning in a group and the knowledge that this person has acquired and uses (Boyatzis, 1982).	motivation, personality traits, self-esteem, knowledge
A set of behaviors that some people master better than others, which makes them work more efficiently in each situation (Lèvy-Leboyer, 1997).	behaviors
A concept broader than qualifications, encompassing all permanent human properties, creating a cause-effect relationship with the high and/or above-average work effects achieved by him, which have a universal dimension (Pocztowski, 2003).	properties
Competences are all the characteristics of employees, knowledge, skills, experience, abilities, ambitions, values, styles of action, the possession, development and use of which by employees enable the implementation the company's strategy in which they are employed (Szczęsna, Rostkowski, 2004).	characteristics, knowledge, skills, experience, abilities, ambitions, values, action styles
Competences are the sum of knowledge and skills and a manner of behavior, necessary for the optimal implementation of specific organizational roles (Lendzion, Stankiewicz-Mróz, 2005).	knowledge, skills, behavior
Group of knowledge, experience, skills, talents, values, attitudes (Jurkowski, 2008).	knowledge, experience, skills, talents, values, attitudes

Source: own work.

Referring to the above-mentioned definitions of competences and taking into account the fact that project management is a field of management dealing with the application of the available knowledge and skills to achieve the assumed results in terms of quality, deadlines and costs (Trocki, 2014), it is stated that the individual competences of the people involved in the projects are the key factors for its success. The comparison of selected definitions of competences shows that most of them are described as skills and abilities to achieve a specific goal. However, knowledge when integrated with abilities, attitudes and even values,

contributes to the success of projects also plays a significant role in defining competences (Mulder, 2014).

2.2. Contextual Competences in Project Management

Contextual competences are defined as "the ability to recognize and consider the relevant interrelated aspects of a design problem's context, comprising the people, places, events, and socioeconomic systems that shape and are shaped by a particular engineering design process" (Atman et al., 2014).

Motamedi (2018) suggests that "contextual competence may include setting, re-setting, renewing of the vision, overarching goals, developing plans and enabling prudent application of tasks and methods toward realization of the vision and achieving strategic goals specific within the defined context".

As Engwall (2003) notes, however, no project „is an island" and cannot be effectively implemented without understanding its context. The context in project management is understood as a set of conditions under which the project is implemented (Świętoniowska, 2015). Świętoniowska (2015) indicates two categories of factors influencing the adaptation of the context to the project management: environmental (e.g., geography, stakeholder) and project (e.g., complexity and maturity). The most frequently answered question in literature relates to how the contextual capabilities should be developed. Leiringer and Zhang (2021) suggest that the contacts or alliances can enable to develop organizational competences in dealing with external factors of projects environment.

The essence of taking into account contextual aspects has also been included in the most popular methodological studies in the field of project management, such as IPMA ICB, Prince2 or PMBoK Guide. IPMA defines the perspective competences for project management which contain necessary elements of knowledge and skills especially used in the analysis of project context and project environment (IPMA, 2015). The Prince2 methodology also paid special attention to the context of the project, as the value of this methodology lies in including „project's environment, size, complexity, importance, team capability and risk" (AXELOS, 2017). The PMI methodology described in PMBoK Guide (2017) also describes factors, which exemplify the projects context, for example considering the needs of stakeholders or implementing business strategies.

3. Perspective Competences by IPMA ICB 4.0

IPMA Individual Competence Baseline 4.0 is the standard with guidelines for managers, couches, scientists and teachers, students and other stakeholders interested in project management. It presents the three main and the most im-

portant sets of competences: people, practice and perspective. Each of these sets consist of elements of skills and knowledge. Furthermore, the ICB 4.O defines the key competence indicators and measures. Table 21.2 below shows the perspective competences and their key components.

Table 21.2. Perspective competences according to IPMA ICB 4.0

Competence	Definition	Skills	Knowledge
Strategy	A performance management system in which projects are seen and managed in light of their alignment with the strategy and the vision (…)	Analysis and synthesis, entrepreneurship, reflection of the organization's goals, strategic thinking, sustainable thinking, contextual awareness, result orientation	Benefits realization management, critical success factors, key performance indicators, organizational mission and vision, difference between tactic and strategy (…)
Governance, structure and processes	The understanding of and the alignment with the established structures, systems and processes of the organization that provide support for projects (…)	Leadership, reporting, monitoring, and control, communication planning and executing, design thinking	Basic principles and characteristics of management by projects, portfolio and programme, basics of organizational design and development (…)
Compliance, standards and regulations	The way how the individual interprets and balances the external and internal restrictions in a given area such as country, company or industry (…)	Critical thinking, benchmarking, adapting standards to specific organizations, communicating standards and regulations, leading by example	Law regulation systems involved, autonomous professional regulation, professional standards and norms, ISO standards, sustainability principles (…)
Power and interests	The way how the individual recognizes and understands informal personal and group interests and the resulting politics and use of power (…)	Observing and analyzing psychological processes, recognizing and using influence, using power when appropriate, discovering values, revealing stakeholders' interests	Formal organization vs informal structures, informal decision-making processes, formal and informal power and authority (…)
Culture and values	The individual's approach to influence on the organization's culture and values and the wider society in which the project is situated (…)	Values awareness, cultural awareness, respect for other cultures and values, aligning to and working withing different cultural environments, dealing with issues related to cultural aspects, bridging different cultures and values to achieve the project objectives	Relevant cultural traits, values, norms, and admissible behavior, organizational mission and vision, mission statements (…)

Source: (IPMA Individual Competence Baseline for Project Management, 2015, pp. 40–63).

The above perspective competences with skills and knowledge components are a cluster of abilities to manage environmental and contextual factors of projects. Furthermore, they are related with other competences from the baseline, e.g., leadership (people competence) or requirements and objectives (practice competence).

Table 21.3 presents indicators and measures of perspective competences. It describes the examples of individual activities which confirm the perspective competences occurrence.

Table 21.3. Indicators and measures of perspective competences

Competence	Sample indicators	Sample measures
Strategy	Identify and exploit opportunities to influence organizational strategy	Identifies new risks and opportunities which could alter the strategy
Governance, structure and processes	Know the principles of project management and the way in which they are implemented	Explains and identifies the current maturity level of an organization
Compliance, standards and regulations	Identify and ensure that the project complies with all relevant health, safety, security and environmental regulations (HSSE)	Defines the HSSE context for the project
Power and interests	Assess the informal influence of individuals and groups and its potential impact on the project.	Is able to discern group affiliations and relationship in relation to the project
Culture and values	Assess the culture and values of the society and their implications for the projects	Works according to societal cultural demands and values without compromising personal values

Source: own work based on: (IPMA Individual Competence Baseline for Project Management, 2015, pp. 40–63).

3. Research Results

The main aim of the research was to determine the level of competences in project management based on IPMA Individual Competence Baseline 4.0. One of the heuristic methods was used in the study – the Delphi method. The empirical material was collected through the use of an expert interview, whose purpose was to use the knowledge, experience and opinions of experts in the field of project management. It was conducted in 2019 among 48 PM Professionals. The group of experts interviewed were members of the IPMA Poland Association: certification assessors, members of accredited training units, representatives of member companies. Furthermore, the respondents were asked about their professional role in their organization. Their declarations of respondent's role were as follows: 52% Project Managers, 29% Product Owners and 19% Senior Managers.

The empirical material was collected using an interview questionnaire which contains, among others, the research question on what should the level of perspective (contextual) competences be. The respondents assessed the level of competences on a 1–5 scale: 1 – very low, 2 – low, 3 – medium, 4 – high, 5 – very high.

The following research question was formulated: *What level of contextual competences do PM Professionals think project managers should have?*

The results of the competences assessments in average is shown in Figure 21.1.
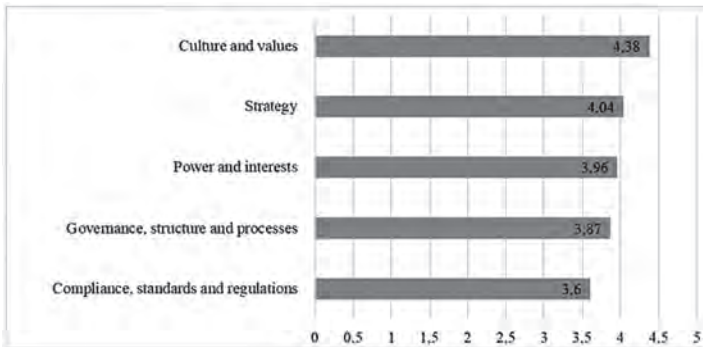
Figure 21.1. Analysis results
Source: own work.

The figure above shows that among the contextual competences, *Culture and values* and *Strategy* dominate, with a score above 4, which means that project managers should have a high level. The assessment of the level of other competences, i.e., *Compliance, standards and regulations*, *Governance, structure and processes*, *Power of interest* oscillates between 3.6 and 3.96, which means that project managers should master these competences at least at an intermediate level.

As far as the research question is concerned, the results of the research conducted among PM Professionals show that project managers should adopt contextual competences at a medium or high level.

4. Conclusion

Summarizing the considerations on the essence of contextual competences in project management, it should be emphasized that the constant changes in the environment are caused by, among others, globalization, technological development, growing customer requirements. All changes that are observed in the project environment affect their implementation and the end result, which is why it is so important that contextual competences should be more often the subject of research and scientific discussions.

The analysis of the literature, in particular the review of the definition of competences, showed that competences are composed of elements of individuals' knowledge, skills and behavior. The results of this review confirm the validity of defining competency sets and their components in IPMA ICB 4.0. Individual Competence Baseline is one of the best standards in the world that define competences, including contextual one, which are necessary for effective and efficient project management.

The results of the empirical research described in the chapter on the assessment of the level of contextual competences in project management showed that the three highest rated elements (culture, strategy and power) are important in the management of large projects. The obtained research results are a derivative of the practical experience of the respondents. The appreciation of the assessed values and cultures as the most important contextual factors can also be associated with the increasingly important trend of sustainable project management. However, the limitations of quantitative research (5-point scale) must be taken into account. When assessing contextual competences, it is recommended to consider the indicators and measures developed for the IPMA ICB 4.0 competency model in the future. The results of the analysis of project managers' competencies carried out in the research process probably reflect the actual level of contextual competences distinguished by managers and present the positions of experts on the approach to project management in accordance with competency models.

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Process Owner's Personality in Creating Pathologies Within Process

Dobrochna Sztajerska

1. Introduction

A lot has been done on the issue of the relationship between the personality traits and leadership (Andersen, 2006; Giberson et al., 2009; Hogan & Judge, 2012; Hogan et al., 1994, Lord et al., 1986). However, it seems that there is still a lack of studies linking personality of the process owner, as well as influencing factors, like national personality traits and cultural values, with specific issues related to the Lean concepts. In many cases the "soft" part of management, especially in Poland, due to the specific national traits, is neglected and sometimes treated as unnecessary. Another thing is that evidence-based knowledge covering aspects of psychology and management most often requires competencies given to a certified psychologists and management specialists, and it is rarely one person, which complicates the studies. One of the areas in which, according to the author, there is a lack of research is the influence of the personality of the process owner and the background influencing it (e.g. national personality traits) on pathologies and among them waste (*muda*), generated by the process. The aim of the study was to answer the question whether there was a chance to identify the relationship between these pathologies and the personality of the process owner and further on, whether it is possible to hypothesize that there is a relationship between the personality of the process owner and the type of identified pathologies, and to conduct further research on a representative sample.

2. Theoretical Context

2.1. Personality and Its Background

Studies show that the personality of managers is closely related to the method of managing the processes under their responsibility (Giberson et al., 2009). According to one of many definitions, personality is a relatively permanent organization of character, temperament, intellect and physical properties that determine specific ways of adapting to the environment (Eysenck, 1977). Some of the components of personality are inherited, some depend on the upbringing or the environment in which one functions. There are many models describing personality (Ashton & Lee, 2001, 2007; Eysenck, 1977; Hofstee et al., 1992; Goldberg, 1999), one of them, as it seems most thoroughly and most often described in the literature, is the Big Five personality traits model by Costa and McCrae (1992a, 1992b). The model suggests five broad dimensions used in common language to describe the human personality, temperament and psyche: openness to experience (inventive/curious vs. consistent/cautious), conscientiousness (efficient/organized vs. extravagant/careless), extraversion (outgoing/energetic vs. solitary/reserved), agreeableness (friendly/compassionate vs. critical/rational) and neuroticism (sensitive/nervous vs. resilient/confident).

The question to start with is why it is important to describe the background of the process owner's personality. There are several crucial reasons. First of all, some studies have found relationships between the (Hofstede's) cultural factors with the average Big Five scores in a country (McCrae & Terracciano, 2005). Secondly, it is vital to recognize that individual differences in traits are applicable in a certain cultural context and that traits have no effect outside that context (Friedman & Schustack, 2015). What is more, it was also found that there is a correlation between some personality traits of a job applicant and the organizational culture they choose (Judge & Cable, 1997). Organizations do not arise spontaneously, instead, they are goal-oriented and have a specific direction (Schein, 2004, 2016), and the goals of the organization are the operationalization of the broadly understood personality of top management (Schneider et al., 1995). It seems that the description of the role of the process owner's personality in the creation of the organizational pathologies cannot be dealt with without looking at the background. In this case, the existence of statistically measurable geographic differentiation in the Big Five personality traits, as indicated by some scientific studies, on the one hand (Terracciano & McCrae, 2005; Rentfrow et al., 2015), and on the other, the consequences of the national culture. As the study described in this paper was, broadly speaking, based on a Polish organization, thus the background data involved Poland.

As far as Polish personality traits are concerned, the people in general tend to be more neurotic, less extroverted, open, agreeable and conscientious than the average (Table 22.1).

Table 22.1. Polish Big Five personality traits

Factor	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
Poland	58.0	47.2	46.5	45.3	46.8
$\bar{X}$	50.6	48.4	48.6	50.7	48.6
Max	60.6	58.1	61.6	59.9	59.5
Min	38.6	38.1	40.8	42.4	34.3

Source: own elaboration (based on Terracciano & McCrae, 2005).

It is said that a good manager should represent a stable model of low level of neuroticism, high levels of extraversion and openness to experience and average levels of conscientiousness and agreeableness (Kraczla, 2017). The underlying reasons were described in different studies (Barrick & Mount, 1993; Deary & Matthews, 1993; DeYoung et al., 2005; Porczyńska-Ciszewska, 2013; Robbins & Judge, 2011; Spirling & Persaud, 2003; Tamir & Robinson, 2004), but the author of the paper believes that it not necessarily fits Polish managers due to our national traits and hence the predominant types of organisational cultures. A low level of neuroticism is recommended because it ensures control over emotions, more optimistic and positive thinking and greater efficiency in coping with stress. Extraversion is quite a significant predictor in the implementation of managerial functions. A person with a high level of openness will be a more effective manager. Overly conscientious people are often too scrupulous, less creative and weaker in coping with sudden and unforeseen changes. Overly kind people, due to excessive submissiveness and manifested concern for the satisfaction of others, may be less firm and less demanding, and thus may be inferior negotiators and supervisors.

Referring to the Polish country culture, the results were based on the Hofstede Insights Culture Compass™ which enables the understanding of the impact of one own cultural preferences and potential behavioral traps while working with people from selected countries. Six dimensions are measured, each with 100 points (more in some cases) to gain: Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long Term Orientation and Indulgence. The results for Poland are presented in Figure 22.1.
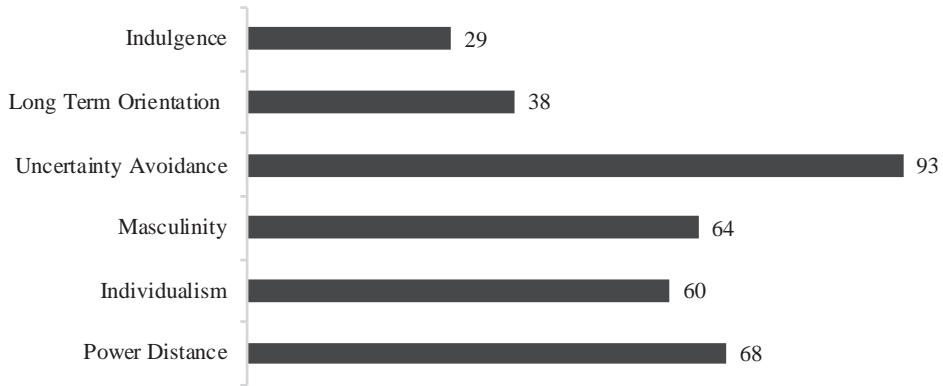
Figure 22.1. Polish Country Culture
Source: own adaptation (based on Hofstede Insight, https://www.hofstede-insights.com/country-comparison/poland/, 12.04.2021).

It turns out unsurprisingly that Poland is a hierarchical society of individualists, with masculine need to be the best, a very high preference for avoiding uncertainty, with low scores within the Long Term Orientation and Indulgence.

2.2. Organizational Pathologies

Organizational pathology is a very broad concept in organizational studies because it can be used to refer to any internal aspects of an organization that has become dysfunctional, counterproductive, inefficient, destabilizing, thus „pathological" (Boardman, 2017). Organization pathology is „a long-term significant irregularity in the functioning of the organization (Pasieczny, 2016). In the paper it is understood as all the negative implications for process management, like waste, resulting from the process owner's personality and its background and context – national personality traits and cultural characteristics.

Waste, called *muda* in Japanese, is a term that is typically associated with the Lean concept. The simplest definition describes *muda* as all the activities that do not add value (Womack et al., 1990). In the classic version, Taiichi Ohno (1988) – the father of the Toyota Production System – distinguished seven types of waste: transport, inventory, movement, waiting, overproduction, rework and defects. Over time in Europe, untapped potential of workers has also been added to the waste list and called skills (Liker, 2003). What is more, there are also country-specific *muda* – for example, in Poland one can distinguish the waste called blaming and related to the search for those responsible for problems and punishing for mistakes. *Muda* is not a fixed concept, different companies and individuals have explained or identified other forms of waste such as production waste, equipment or start-up waste (Roberts & Sergesketter, 1993). They are all

exhibited in workplaces, although their size and nature will depend on the organization, but overproduction is said to be the mother of all of them. It creates a lot of traffic and transport, generates inventory, hides quality problems among others.

Other pathologies that can result from the personality of the process owner, its context and background can be difficult to predict, because they also depend on the nature of the process, the process owner and the organization as a whole. The author of the article made an attempt to identify visible problems in this regard, but it needs further and deeper study. Some issues were described in the Results section.

3. Methods

The research involved not only a study of the maintenance process owner's personality, but also of the organisational culture, waste and pathologies. The study scheme is presented in Figure 22.2. Due to editing restrictions, only some results and conclusions were presented and not always supported by in-depth analysis. Those interested in the details of the study are encouraged to contact the author.

More tests than these presented in the scheme (Figure 22.2) were conducted (i.e. CISS to diagnose the styles of coping with stress, STAI – to study anxiety understood as a transient and situational state of an individual, and anxiety understood as a relatively constant personality trait, especially important during the pandemic, etc.), but only these described in this paper are shown in Figure 22.2.

The study was based on the Competing Values Model (CVM) by Cameron and Quin (1999) that uses the Organisational Culture Assessment Instrument (OCAI) to test the current and the desired type of culture. The model is based on two dimensions, with two opposite characteristics: stability versus flexibility and internal versus external orientation. The dimensions form axes that divide a plan into four quadrants representing opposites that compete with each other (Chuda, 2017) and create four different cultures: group, developmental, hierarchical and rational.

An original *muda* assessment tool for identifying waste in Polish organisations was used. Twelve categories of waste and several examples of each of them were identified. Except those mentioned in the paper (motion and transportation were combined), also: looking for and explaining, lack of employee involvement, improper indicators, misuse of computer/telephone). The respondents had as well the opportunity to provide their own examples, if they fit the category and were not present in the tool. The respondents – 14 employees of the process, including the process owner – were sent a questionnaire via business e-mails, the process
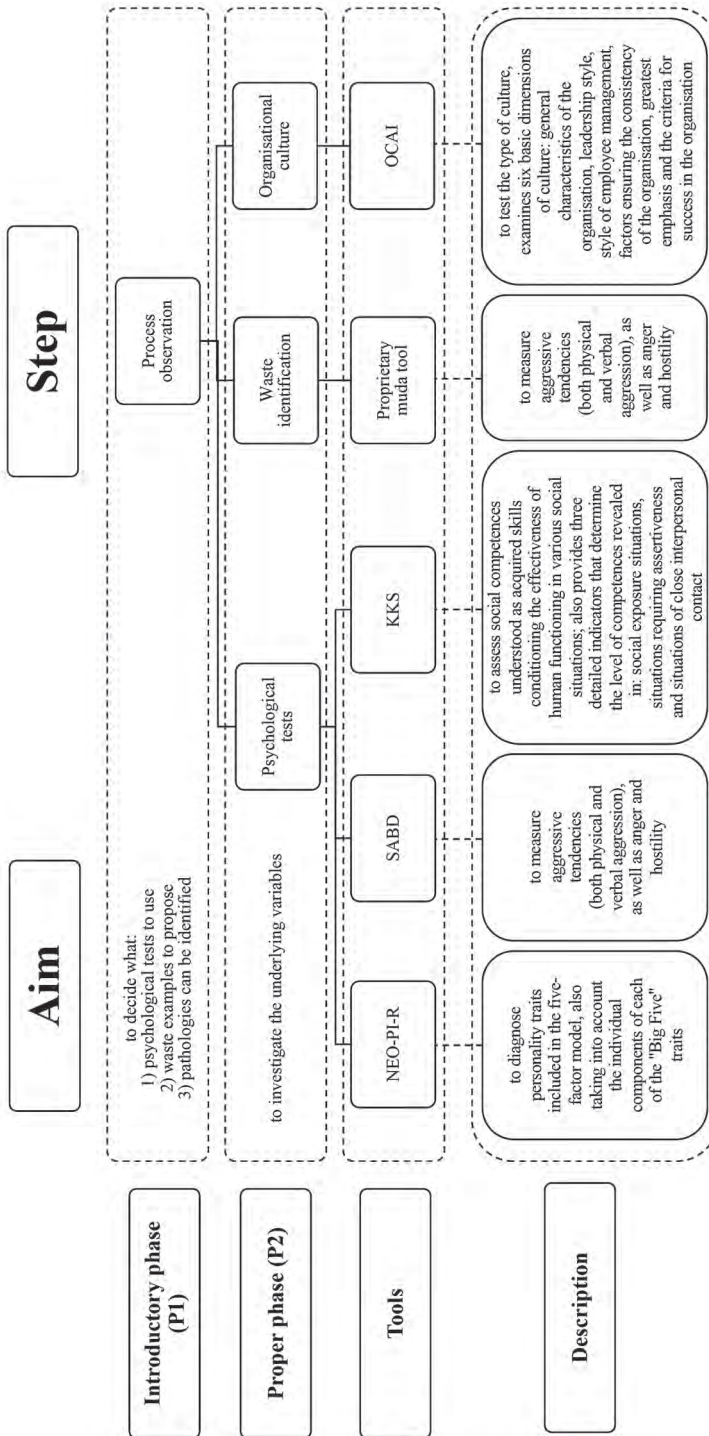
Figure 22.2. Study scheme
Source: own elaboration.

owner had been trained in how to correctly fill it in to instruct the others. Employees within 5 days registered waste in accordance with the proposed tool.

The study presented in this paper is a part of a bigger project that has been conducted since the end of last year, and some of the results obtained so far have already been presented, for example the role of the organizational culture in generating waste (Sztajerska & Pawlusiak, 2021).

4. Results

Main examples of waste diagnosed in the process under study are listed in Table 22.2 and only these most frequent were presented.

Table 22.2. Key waste examples in the researched organisation

Waste	Example	Culture/Owner C/O
Overproduction	excessive number of business meetings	C
	printing documents that may be electronic	O
	receiving messages in ELOI and by e-mail	O
Motion, transportation	transferring documents of one type/case between rooms, floors, buildings	C
	departures for meetings, although could be online	O
Overprocessing	gathering too detailed and too much information	O
	other department's documents explanation	C
	creating reports that no one analyses	C
Waiting (for)	superior's signature	C
	documents from other departments	C
	feedback	O
	office device to work	C
Searching, finding out	searching for files on computer	O
	searching for documents	O
	explaining problem situations	C
Skills (E)	wasting potential on things others should do	C, O
Blaming (PL)	external between processes – between departments	C, O
Wrong indicators	collecting data unrelated to the organizational context	C, O
Lack of employee involvement	in matters arising directly from scope of activities	C
Misuse of computer/telephone	games	O

Note: C – resulting from the organisational culture; O – resulting from the process owner's personality.

Source: own elaboration.

The organisation in which the studied process owner works, according to a model of competing values, represents a rational culture, but shows as well many characteristics of a hierarchical one and desires a group culture (Sztajerska & Pawlusiak, 2021). The analysed process is oriented towards stability and control, target setting and planning are the way to achieve goals, the aims are productivity and efficiency and the leader is seen as a supplier and manager. According to the studies, rational culture demands a manager that represents high level of neuroticism and low level of agreeableness (Giberson et al., 2009). Taking into account Polish Big Five personality traits such a culture should be desirable as suiting our national traits. The same applies to the hierarchical culture, which is additionally supported by the Polish Country Culture diagnosed be the Hofstede Insight. The hierarchical culture prefers leaders characterized by low levels of extraversion and openness. As far as the maintenance process owner is concerned, he presents an average level of neuroticism and agreeableness and high levels of all the other traits – extraversion, openness to experience and conscientiousness (results obtained with NEO-PI-R by Costa and McCrae).

It is not in accordance with the current organizational culture – neither the rational nor the hierarchical, but close to the desired culture that demands lower levels of neuroticism and average of agreeableness. This difference between the personality traits of the process owner and the requirements of the organizational culture may result in the process owner being required to be aggressive in competition, engage in expansion and rapid response to market needs and represent a style of goal-oriented, directive and hard management, which is mostly not consistent with the process owner's personality. Such diagnosed waste can be the result of:

- skills, especially wasting potential on things others should do – as a result of inability to manage by ordering and therefore performing activities by himself,
- overprocessing, in particular gathering too detailed and too much information – due to the excessive need to control all variables,
- blaming – as a result of too many tasks to perform and overwork and the need to hide the problems,
- misuse of computer – to relax and escape from the pressure of the work environment (gaming was the form of escapism, diagnosed by psychological tests and observation).

The results of the SABD test show that the dominant aggressive behaviour of the process owner is indirect aggression, while the hostile behaviour (Buss & Plomin, 1984) is guilt. Indirect aggression occurs when an attack is directed at surrogate objects, for instance people or things that are not the proper ob-

ject of aggressive behaviour. Research confirms (Cairns, 1986; Locke & Bogin, 2006) that in the case of awareness of the importance of and the need to maintain a high level of social relations, indirect aggression is more often manifested. Taking into account the way in which interactions take place in the workplace of the process owner ("conquest wars", gossips, etc.) and the position taken by him, but also the diagnosed lack of assertiveness towards authorities, it seems that his score on the aggression scale reflects it. It appears that the following waste may be the result of this state of affairs:

- waiting – the time it takes to calm down and return to duties that delays the completion of tasks,
- blaming – as above,
- lack of employee involvement – lack of sense of the tasks performed by the process owner on the one hand, and the lack of proper supervision over employees on the other,
- misuse of computer – as above.

Social competences are extremely important among employees' dispositions. Five scales of the KKS questionnaire are measured: assertive competences (A scale), competences cooperative (K scale), social competences (T scale), social resourcefulness (Z scale) and social skills (S scale). Social competences are mostly the strengths of the process owner. The exception are the assertive competences, especially in contacts with the authorities, which can result in the following waste:

- overproduction – due to the inability to negate the need to perform unnecessary activities,
- skills – as above
- blaming – as above,
- lack of employee involvement – as above,
- misuse of computer – as above.

Much of the waste duplicates and will also possibly generate other problems, especially overproduction that can create much motion and transportation, generate inventory and hide quality problems, among others.

5. Summary

The role of the process owner's personality in creating organizational pathologies should not be overlooked, but always considered in the context of organizational culture and country traits as a background for drawing conclusions. As stated above, several of the Big Five personality traits are related to the candidates' preferences regarding the choice of organizational cultures (Judge & Cable,

1997). Moreover, senior managers are considered to be the main factor influencing the creation and development of organizational culture (Bennis & Nanus, 2007; Kotter & Heskitt, 2011; Schein, 2004; Trice & Beyer, 1993). This may indicate that there is a close relationship between who manages the process and the process itself – both in relation to healthy and pathological areas of its functioning. Thus, it seems crucial to determine the personal traits of the process owner to indicate any problems that may arise. Especially that each of the process owners may have different personality traits, some coinciding with the requirements of the organizational culture, others being in opposition. The author of the study is aware that the study needs to be conducted on a larger group of process owners, confronted with the organisational culture and existing pathologies. The Competing Values Model may not be sufficient and may distort the obtained results, as it does not explore all the dimensions, for example organisational pathologies, but the study seems to provide evidence that it is worth exploring this area further that the statistically significant link between the personality of the process owner and the type of identified pathologies might exist.

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Non-financial Disclosures and the Competitiveness of Listed Companies

Krzysztof Dobrzanowski

1. Introduction

In connection with the dynamic development of non-financial reporting, the paper addresses the issue of the impact of non-financial disclosures on the competitiveness of listed companies. Despite the lack of specification of the term "non-financial information", a number of qualitative characteristics are attributed to this information and it is indicated that this information is an important tool for creating company strategy. Nowadays, it is an important concept for economic entities and, first of all, for capital companies. They operate in a free market and are subject to the phenomena of that market. The European Union, following changes from Western Europe, enacted Directive 2014/957UE, regarding the requirements for enhanced reporting of non-financial information, which amended the Polish Accounting Act in 2017. The literature emphasizes that non-financial reporting aims to: ensure a broader consideration of the sources of value creation in the organization of the interrelationship between sustainable development and financial performance, and provide information about the business model of the organization and also estimate the forecast of future development of the organization and growth of its value (Bek-Gaik 2017). However, there is no clear position in the research findings that there is a positive relationship between non-financial disclosures and increased competitiveness of firms. Due to the fact of different definitions of competitiveness and types of its classification, there are many measures to evaluate this phenomenon. Micro indicators are taken into consideration when assessing competitiveness. A company's level of competitiveness is determined by its market position and stakeholder evaluation. In strategic management theory, competitive capability is a fundamental factor in achieving competitive advantage. It includes factors such as market share, service, brand, distribution, marketing, research and development, man-

agement competence, quality reliability and innovation. Given these issues, the existing body of work recognizes a gap in research on the relationship between non-financial disclosures and corporate competitiveness. Therefore, the purpose of this paper is to try to demonstrate the impact of non-financial disclosures on the competitiveness of companies based on a literature review.

2. Non-financial Disclosures

The publication of non-financial information has become increasingly important to the broader operations of companies (Fernandez et al, 2011; Matsumoto et al, 2011; Ellis et al, 2012). Non-financial information often refers to intangible assets such as employee knowledge, customer satisfaction, or distribution channels, which are considered to be the main value drivers for the firm (Zéghal & Maaloul, 2011). The lieterature indicates that companies with higher levels of disclosure achieve greater competitiveness which is due to their achievement of better financial ratios and the presence of a positive relationship between competitiveness in raising capital in non-financial disclosures (Cassar 2009, Bamber et al, 2010, Karim et al. 2013, Sampath et al.2018, Khemir, 2019, Neveed et al. 2020). Non-financial disclosures often referred to as non-financial information have not yet received a uniform definition. A comprehensive review of definitions of non-financial disclosures is presented in Bek-Gaik, Krasodomska (2018). Most commonly, non-financial disclosures are defined as: "any information (descriptive or numerical, and not necessarily expressed in a monetary measure) published (either mandatorily or voluntarily) as part of a company's annual report, outside of the financial statements and the auditor's opinion and report" (Krasodomska, 2014, p. 28). This approach is in line with the one proposed in the Jenkins Report (Jenkins Committee Report… 1994) and presented in works by authors such as H. Gernon and G.K. Meek (2001), S.W.G. Robb, L.E. Single and M.T. Zarzecki (2001), K. Gazdar (2007), E. Cauvin, C. Decock-Good and P.-L. Besos, (2006). In turn, A. Kamela-Sowińska indicates that "non-financial information is supposed to show what an entity has decided to accomplish in three areas: economic, social and environmental, and then whether these goals have been achieved" (Kamela-Sowińska 2016, s. 19). The amended Accounting Act provides the minimum scope of non-financial information related to an entity's operations, such as (Accounting Act, 1994, Article 49b(2)): – a concise description of the organization's business model; – key non-financial performance indicators related to the business; – a description of the company's policy on labor, social, respect for human rights and the environment and anti-corruption issues, as well as a discussion of due diligence procedures and the results of ap-

plying this policy; – a presentation and description of the system for managing significant risks that may have an adverse effect on labor, social, respect for human rights and the environment issues, including issues related to products or relations with the company's external environment.

In 2018, Polish companies were required to disclose non-financial information as a result of the introduction of the EU Directive 2014/95/EU of 2014 and the amendment of the national Accounting Act. It is presumed that this will result in a premium being placed on sustainable businesses. The literature and practice also discuss problems and dilemmas related to the reporting of non-financial information. Among the fundamental problems are:

- reliability of the data presented, mainly of a non-financial and prospective nature,
- lack of a uniform form of integrated reporting,
- create an appropriate database for integrated reporting,
- too much information (information overload), and consequently difficulty in filtering out information relevant to investors' decision-making,
- a great deal of freedom in the "creation" of non-financial information,
- the lack of a set of indicators of organizational performance preferred for disclosure in integrated reporting; it should be noted that the framework for integrated reporting does not propose any set of indicators showing the effects of organizational activities (Bek-Gaik 2017).

As Błażyńska (2019) points out, while financial information has been codified, attempting to standardize non-financial information is a difficult challenge. Such activities are undertaken under the UN Global Compact, OECD guidelines or the Global Social Initiative, among others. A breakthrough in the reporting of non-financial information is the implementation of Directive 2014/95/EU with regard to the disclosure of non-financial and diversity information by certain large entities and groups. Directive 2014/95/EU required certain entities to disclose non-financial information as of January 1, 2017, leaving the choice of reporting principles, standards and guidelines discretionary.

There are also many classifications of non-financial disclosures. One classification was proposed by GRI G4 mainly in relation to CSR issues. Another classification was proposed by IIRC and another classification was proposed by Standard on Non-Financial Information (SIN). SIN consists of a core part and five annexes. The basic part covers issues such as: non-financial reporting and its scope, country and sector specifics, the importance of metrics and their selection from the point of view of capital markets, and the scope of the standard and descriptions of individual reporting areas (SIN, 2017). SIN also includes detailed regulations in annexes on:

- legal interpretations of Directive 2014/95/EU – description of the criteria triggering the obligation to report information on non-financial information,
- materiality matrix – a matrix combining the areas and indicators provided by the SIN combined with their potential importance by industry,
- stakeholders and key areas of responsibility – highlighting the fundamental importance of the company's relationship with its stakeholders,
- the importance of metrics and their selection from the perspective of the capital markets, which are intended to make it possible to determine the extent to which a company's goals and plans are being met,
- detailed description of the following areas: management (G), environment (E), and social and labor (S).

The Standard for Non-Financial Information (SIN) contains 15 indicators in the management area, 30 indicators in the environmental area and 78 indicators in the employee area. SIN distinguishes three reporting areas, i.e., the management area, the environmental area, and the social and employee area, assigning a specific set of indicators to each of them. The standard emphasizes that the selection of metrics should be guided by the ability to demonstrate trends in the companies' performance, where possible by industry.

Thus, the literature highlights numerous benefits of non-financial information disclosure. And among them the increase in transparency of the organization's activities, disclosure of environmental and social factors and their beneficial impact on financial performance, building reputation, trust, brand.

3. Competitiveness

The level of competitiveness of a company is determined by its position in the market and the assessment of its stakeholders. Therefore, it can be considered that its competitiveness results from strategic actions that determine the growth of its market value. In strategic management theory, competitive capability is a fundamental factor in achieving competitive advantage. It includes factors such as market share, service, brand, distribution, marketing, research and development, management competence, quality, reliability, and innovation. When evaluating the competitiveness of an entity, one should also convict a significant impact of activities related to corporate social responsibility on its formation. A correct estimate of a firm's competitiveness can be obtained by measuring competitive potential, which is a multidimensional variable. Many economic, intellectual capitals, environmental management metrics are used to estimate it, e.g ROE, market share, R&D expenditures, carbon emission meters. Because com-

petitiveness is included in the category of relative characteristics, its determination requires comparison with a standard of comparison, such as the average obtained for the entire collective. Competitiveness reflects a company's potential – resources, skills and abilities that provide an advantage over other entities operating in the same sector (Walczak 2010). Competitiveness is the ability of a company to grow sustainably over the long term and the drive to maintain and expand market share (Lubiński 2010). The literature lists different types of sources of competitiveness (e.g. Szymański 1995): production – distribution marketing technological resulting from the place on the market such as trademark, patents, reputation, uniqueness of the company and its product, the quality of management such as management expertise, knowledge and information, time management, i.e. – the ability to react faster than competitors to market changes. In modern companies, the competitive potential is based on knowledge and information resources and brand capital, human capital, customer-orientation, and less on working capital and physical capital, which can be acquired through outsourcing (Read et al., 2004, p. 21). The competitive advantage can be defined as a superior position over competitors obtained by offering customers greater value at lower prices or by providing customers with additional benefits and services over those offered by competitors. Szwacka-Mokrzycka, and Miara (2010), p. 235, in turn, indicate the importance of market assets understood as elements co-creating enterprise value in building enterprise competitiveness. Analysis of the state of market assets plays an important role in the process of evaluating the situation of an enterprise and the prospects for its development, choosing specific objectives and strategies for their implementation. In the literature there are many methods of assessing competitiveness and a wide selection of its measures. From the point of view of the dissertation objectives, the choice of the method of competitiveness assessment is important. According to J. Walas-Trębacz (2013 p. 33–40) they can be divided into:

- methods based on the evaluation of the effects of the company's activity, including two analytical indicators of the company's market share, defined by the volume of sales of the company relative to sales in the entire sector,
- methods based on comparative assessments of characteristics most important from the point of view of the recipients, such as benchmarking, strategic segmentation, value analysis, etc.,
- methods based on the company's factor evaluations (resource assessments) such as value chain model, cost analysis, resource analysis, product life cycle analysis, technology, etc.,
- mixed methods – these methods are based on the evaluation of the effects of competitive activities of the company and on comparative assessments of

characteristics important to customers, as well as on the evaluation of factors of production (resources) such as portfolio methods, strategic balance of the company.

It should also be emphasized that due to the fact of different definitions of competitiveness and its different classifications, there are many measures of evaluation of this phenomenon (Bartoszewski & Pniewski 2008). In the micro scale, when evaluating competitiveness most often economic and financial results of the organization are taken into account, for example:

- level of investment,
- net profit,
- enterprise value,
- market share, etc.

Traditional accounting-based measures of value creation are also used. We can distinguish:

- ROI (return on investment),
- ROA (return on assets),
- a ratio representing the company's return on equity ROCE (return on capital emplloyed),
- return on net assets (RONA),

Among the new proposals for measures of value creations that take into account the cost of capital employed are:

- EVA (economic value added),
- SVA (shareholder value added),
- CFROI (cssh flow return on investment),
- CVA (Credit valuation adjustment),
- EP (enterprice value),
- ROACE (Return on Average Capital Employed).

4. Non-financial Disclosures and Competitiveness

Non-financial disclosures and their rapid growth have prompted the need for in-depth research into their validity and uses. To date, the few studies of the issue of the relationship between the level of non-financial disclosures and the competitiveness of companies have not led to clear conclusions (Mahadeo et al. 2011, Bhardway & Mangal 2012). Ongoing research on the relationship between non-financial disclosures and firm value has not led to conclusive results. The lack of conclusive results in this area is caused, among other things, by the wide range and diversity of CSR disclosures, diverse measurement methods and indices constructed by individual authors. The situation is similar to environ-

mental and management disclosures. Very often these are narrative descriptions not supported by numerical data. It is worth citing in this context the study of Yagenehi, Barzegar (2014), which showed the relationship of corporate social responsibility (CSR) reporting of both social and environmental aspects with the financial performance of the company in terms of both accounting and market parameters. Similarly, Agu and Amedu (2018) stated that companies should include environmental and social factors in their reports because of their impact on financial performance. During a study conducted in Nigerian pharmaceutical companies, they confirmed the positive relationship between CSR reporting and return on assets (ROA), return on equity (ROE) and net profit margin (NPM). A meta-analysis-based study by Friede's team with colleagues (Friede et al. 2015) provided compelling evidence that companies that perform well on ESG criteria generate better financial performance. They found that about 63% of the studies conducted over 44 years showed a positive relationship between companies' ESG performance and financial performance. This trend has been relatively stable since the mid-1990s, but it is weakest for the social factor and strongest for the governance factor. In contrast, a study conducted by a team led by Dimson (Dimson et al. 2015) analyzed material from 2152 interviews conducted by asset managers with 613 US companies over a ten-year period. The results indicated that the chance of a company changing its behavior after shareholder intervention was 18%, with a maximum of two or three interventions conducted over a period of one to one and a half years considered the most effective. It found that the company's stock rose 7.1 percent in the year after it made positive changes to responsible (sustainable) investing pushed by shareholders. Thus, the authors conclude that the increase in stock prices is due to the fact that firms that take shareholder suggestions into account begin to achieve better operating results, higher profitability, and consequently, their stock prices begin to fluctuate less. The positive market reaction to effective engagement is most significant for corporate governance (+8.6%) and climate change (+10.3%). If engagement fails to deliver results, earnings improvement declines again. To sum up, we can point out that non-financial disclosures are a valuable source of information for investors, which makes it easier to make investment decisions and provides a sense of comfort, and ultimately reduces the cost of raising capital (Report "Responsible Business…", 2012, p. 29). Non-financial reporting also has an impact on shaping a positive image of the company, strengthening relations with stakeholders and increasing their loyalty. Moreover, according to an international organization, Global Reporting Initiative (GRI), the benefits of non-financial reporting enable: building trust, improving the company, advancing the vision and strategy, reduc-

ing the cost of violations and ultimately the competitive advantage (Non-financial Reporting, 2017).

5. Summary

As a result of the analysis of measures of competitiveness, it can be seen that this assessment has undergone evolution and non-material factors have begun to play an increasingly important role in competitiveness. Hence, to undertake research on the impact of non-financial disclosures on the competitiveness of companies seems to be the most justified. It should be emphasized that intangible factors play an increasingly important role in the success of an organization and have a significant impact on its performance. The resource approach emphasized by IIRC clearly emphasizes that the value of a company in the short, medium and long term is influenced by both financial, human, natural, intellectual, social, relational resources. Information about the above-mentioned resources is contained in the so-called Non-Financial Reports (non-financial reports), among which CSR reports, sustainability reports, integrated reports, management commentaries and others dominate. The competitiveness of a business can be evaluated from the point of view of different stakeholder groups, namely: customers, business management, business owners, employees, potential investors, banks, suppliers, etc. If it comes to measures of competitiveness their choice is a difficult task, as it seems that the most often chosen are ROA, ROI and enterprise value because of their wide availability and the possibility of calculation. The above literature review indicates that, although the literature claims that there is no evidence of the impact of non-financial information on corporate competitiveness, current research (also conducted by rating companies), provide more and more evidence of the interrelation of these variables. Therefore, it is reasonable to search for methods and to conduct research to assess the impact of non-financial disclosures on the performance of organizations and their competitiveness.

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The Importance of Features of the Offer in the Sphere of Innovation and R&D. A Comparison of Dairy Cooperatives from Małopolskie and Świętokrzyskie Voivodships

Izabela Konieczna

1. Introduction

Innovations are the basis for ensuring the development of the company and increasing the attractiveness of the offer for customers (Kalinowski, 2010, p. 44). Value innovation is the emphasis on what customers really need, and not on how to beat competitors in the current field; it is the belief that rules are not the same – they can be shaped anew (Altkorn, 2002, p. 40). Therefore, it is crucial for companies to know what their customers need and what their expectations of the company are. Based on this, the purpose of the article – an analysis of the validity of the features of the offer for customers in the area of innovation and R&D in the assessment of dairy cooperatives from the Małopolskie and Świętokrzyskie voivodeships – was determined. The cooperatives' executives were asked to assess the validity of features of the offer for such customers as consumers, companies-users (gastronomy), wholesalers, independent retail grocery stores, large retail chains, local retail chains, intermediary agents in food trade, other dairies, and other institutional purchasers. To fulfil the aim, the following questions were posed:

1. Are cooperatives' representatives aware of the validity of features of the offer for their customers in the area of the innovation and R&D?
2. Is there much difference in the opinion of cooperatives' representatives from both voivodships about the importance of features of the offer in the sphere of innovation and R&D for different customers?
3. Are features of the offer in the sphere of innovation and R&D more important for consumers than for different kind of entities?

2. Innovation and R&D

Innovative activity of enterprises should be treated as a fundamental factor of economic and civilizational progress, which favours development, maintaining a good position on the market and increasing operational efficiency (Rytlewska, 2005, 255).

We can find many different definitions of innovation (Table 24.1). According to O'Sullivan and Dooley innovation is the process of making changes, large and small, radical and incremental, to products, processes, and services that results in the introduction of something new for the organization that adds value to customers and contributes to the knowledge store of the organization (O'Sullivan & Dooley, 2008, p. 5). In the theory of business management, the concept of innovation is understood as:

- introducing new products to production or improving the existing ones,
- introducing a new or improving the existing production process,
- opening a new market,
- the use of new raw materials and semi-finished products,
- introduction of a new production organization (Rytlewska, 2005, p. 255).

Table 24.1. Selected definitions of innovation

Authors	Definition
J.A. Schumpeter (1934)	Creation of new combinations of existing resources.
OECD/Eurostat (2005)	Implementation of a new or significantly improved product (good/service) or process (method/practice/relationship).
G. Mulgary and D. Albury (2003)	Innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality.
National Audit Office (NAO) (2009)	The successful exploitation of new ideas or ones that are adopted from other sectors or organizations'.
Australian National Audit Office (ANAO) (2009)	Creation and application of good ideas.
Confederation of British Industry (CBI)/ QUINETIQ (2008)	A continuous and dynamic process in which ideas are transformed into value.
Economic and Social Research Council (ESRC) (2008)	The successful introduction of new services, products, processes, business models and ways of working.
F. Damanpour and M. Schneider (2009)	The development (generation) and/or use (adaption) of new ideas or behaviors.
H.A. De Vires, V.J.J.M. Bekkers and L.G. Tummers (2014)	The introduction of new elements into a service—new knowledge, new organization, new management/skills.
A. Evers, B. Ewert and T. Brandsen (Eds.) (2014)	Innovations are in a significant way new and disruptive towards the routines and structures prevailing.
NESTA (2012)	Innovation is the process by which new ideas turn into practical value in the world.

Source: (Taylor, 2017, p. 131).

Innovation may be defined and measured narrowly in terms of research and development (R&D) or technological innovation, which is associated with the development of new products and processes (Bristow, Healy, 2018, p. 266). Innovation is most often explained by the extent of in-house R&D efforts, as well as out-sourced R&D services (Shefer, Frenkel, 2005, p. 26). R&D activity is a planned and continuous creative work carried out in order to increase a specific resource of knowledge and its implementation in innovative applications (Morawski, Kobyłko, 2006, p. 201). A firm's decision to invest in R&D may be influenced by a number of factors, among which is the firm's current level of innovation (Shefer, Frenkel, 2005, p. 26). The lack of innovation in the company indicates either that it is unable to systematically find and explore new opportunities, or that it invests in many new opportunities with unsatisfactory results (Kotler, 2005, p. 72).

In a highly competitive market based on the knowledge economy, innovation is considered a necessary condition for the company's survival. To a large extent, it focuses on products and services provided, but also applies to the entire organization, its forms and methods of carrying out activities (Mikuła, 2006, pp. 22–23). Innovativeness as a competitiveness shaping factor results from several premises:

■ innovation contains an element of novelty and change, therefore it is dynamic and creative,

■ innovativeness is a factor related to other factors influencing the growth of competitiveness, both at the entrance. as well as at the exit, which means influencing the overall efficiency of the company's operations,

■ the impact of innovation on other factors in the context of competition is generally synergistically positive,

■ innovations have a strong impact on creating market demand, which is an extremely important factor in shaping competitiveness (Janasz & Wiśniewska, 2013, p. 21).

R&D activity is a catalyst for innovative industrial activities, and ultimately it is responsible for the growth in productivity and total revenue (Shefer & Frenkel, 2005, p. 30). Firms invest significant resources in research and development (R&D) activities to discover qualitatively improved products and capture associated profits (Segerstrom, 1991, p. 807). Firms which invest more in research and development tend to perform better than their non-innovative counterparts through crises and have better long-term survival rates (Bristow & Healy, 2018, p. 266). The research results show that the magnitude of R&D expenditure in the group of firms that belongs to a concern is by far larger than that of individually owned firms as well

between affiliated firms than in high-tech industries and traditional industries (Shefer & Frenkel, 2005, p. 31).

As M. Kostera writes, the competitiveness of companies in the global economy is influenced by the level of their investment in research and development (R&D). R&D is of operational importance for the organization, as it allows recognizing new market opportunities, finding previously unknown applications of existing products or introducing technological innovations to production processes (Kostera, 2008, p. 378). The process of industrial R&D, in which scientific principles and properties of the natural world are transformed into commercial products and processes, consumes large amounts of resources (frequently over many years) before economic gains from product sales are realized (Varma, 2000, p. 52), however such activity is important for gaining and maintaining a competitive advantage, especially in those sectors where market success depends on technological innovation (Kostera, 2008, p. 378).

Since the tendency and ability to create new and improve existing products, new technologies and organizations and management systems are the result of innovative activities, it is extremely important for enterprises to be aware of what features of the offer are important for their customers from this point of view. Such knowledge will allow to target innovation and R&D activities to meet customer expectations and, as a result, achieve a competitive advantage.

3. Features of the Offer in the Sphere of Innovation and R&D – Research Results

The research was conducted among dairy cooperatives from two voivodships. These cooperatives are classified in section 10.5 of the PKD (Polish version of NACE) and deal in:

- production of fresh liquid milk, sterilized milk (including pasteurized milk or milk treated with very high temperatures (so-called UHT)) and homogenized milk,
- production of non-alcoholic beverages based on milk,
- production of cream from fresh milk: sterilized (including cream pasteurized or treated with very high temperatures (so-called UHT)), homogenized,
- production of dehydrated or concentrated, sweetened or unsweetened milk,
- production of milk or cream in solid form,
- production of butter,
- production of yoghurt and kefir,
- production of cheese and cottage cheese,

- production of whey,
- production of casein and lactose.

The research was conducted among cooperatives' executives who were asked to assess the validity of features of the offer for customers in the innovation and R&D. All dairy cooperatives from the Świętokrzyskie and Małopolskie Provinces were asked to take part in the research, however, because of the tendency of the representatives of cooperatives to participate in the research, the research had been conducted on a sample of 7 out of 17 dairy cooperatives from Świętokrzyskie and Małopolskie provinces, i.e. 41% of cooperatives functioning in the year of the research, using an interview questionnaire. The interview questionnaire was structured. However, the respondents had the possibility to indicate other features of the offer, but none of the cooperatives indicated other features around innovation and research and development. Interview results are shown in Table 24.2.

Table 24.2. Features of the offer in the sphere of innovation and R&D in the assessment of dairy cooperatives from Małopolskie and Świętokrzyskie Voivodships

Features/elements of the offer	Voivodship	Consumers	Companies – users (gastronomy)	Wholesalers	Independent retail grocery stores	Retail chains		Intermediary agents in food trade	Other dairies	Other institutional purchasers	Mean	Average deviation
						Large	Local					
Innovation												
The degree of modernity of the product, i.e. its innovativeness	Ś*	4.00	4.00	4.00	0	0	4.00	0	0	0	4.00	0.790
	M*	4.00	4.25	4.25	4.00	4.00	4.50	0	0	0	4.17	1.666
Compliance with fashion trends	Ś*	4.00	3.50	4.00	0	0	3.67	0	0	0	3.79	0.595
	M*	4.00	3.75	4.00	4.00	4.00	4.00	0	0	0	3.96	0.747
More frequent than competitors introduction of new products to the market	Ś*	4.00	3.00	3.67	0	0	3.33	0	0	0	3.50	0.661
	M*	3.75	4.25	4.25	5.00	3.00	3.75	0	0	0	4.00	0.556
More frequent than competitors product innovation	Ś*	4.00	4.00	3.67	0	0	3.33	0	0	0	3.75	0.446
	M*	4.25	4.50	3.75	4.00	4.00	3.75	0	0	0	4.04	0.432
Highlighting of products against competitors' products	Ś*	4.00	3.50	4.67	0	0	3.67	0	0	0	3.96	0.364
	M*	4.50	4.25	5.00	4.00	3.00	4.25	0	0	0	4.17	0.611

Table 24.2. cnt'd

Features/elements of the offer	Voivodship	Consumers	Companies – users (gastronomy)	Wholesalers	Independent retail grocery stores	Retail chains		Intermediary agents in food trade	Other dairies	Other institutional purchasers	Mean	Average deviation
						Large	Local					
Mean of features/elements of the offer in the case of innovation	Ś*	4.00	3.60	4.00	–	–	3.60	–	–	–	3.80	
	M*	4.10	4.20	4.25	4.20	3.60	4.05	–	–	–	4.07	
R&D												
Products' manufacturing based on the use of market research results relating to the needs and expectations of consumers, the motives for taking the decision to purchase, market trends and market structure	Ś*	3.33	4.00	4.00	0	0	3.67	0	0	0	3.75	0.397
	M*	4.00	4.00	3.50	3.00	4.00	3.75	0	0	0	3.71	0.519
Maintaining contacts with customers during the phase of product concept development	Ś*	4.00	4.00	4.33	0	0	3.67	0	0	0	4.00	0.182
	M*	4.75	4.00	3.75	4.00	4.00	4.00	0	0	0	4.08	0.593
Maintaining contacts with customers during the implementation phase of the product concept	Ś*	4.00	3.50	4.00	0	0	3.33	0	0	0	3.71	0.397
	M*	4.00	4.00	4.00	0	0	4.00	0	0	0	4.00	0.500
Rapid response to customer signals on the presented offer	Ś*	4.33	4.50	4.33	0	0	4.33	0	0	0	4.37	0.579
	M*	4.33	4.00	4.00	0	0	4.00	0	0	0	4.08	0.611
Mean of features/elements of the offer in the case of innovation	Ś*	3.92	4.00	4.17	–	–	3.75	–	–	–	3.96	
	M*	4.27	4.00	3.81	3.50	4.00	3.94	–	–	–	3.97	

* Ś – Świętokrzyskie Voivodship; M – Małopolskie Voivodship
Scale: 1–5, where 5 – extremely important, 4 – very important, 3 – quite important, 2 – of little importance, 1 – completely unimportant, 0 – not applicable.

Source: own work and (Konieczna, 2016, p. 176).

Analysis of Table 24.1 and Figure 24.1 clearly indicate that:

- The degree of modernity of the product, i.e. its innovativeness was considered as very important for consumers, companies-users (gastronomy), and wholesalers in the case of both voivodships, and for local retail chains in the case of Świętokrzyskie Voivodship. It was considered to be very important for independent retail grocery stores and large retail chains in the case of Małopolskie Voivodship. At the same time, cooperatives from Małopolskie Voivodship considered this feature as extremely important for local retail chains.

- Compliance with fashion trends was found to be very important for consumers, wholesalers, local retail chains, and companies-users (gastronomy) in the case of both voivodships. Additionally, cooperatives from Małopolskie Voivodship claimed that this feature is also very important for independent retail grocery stores and both large and local retail chains.

- More frequent than competitors introduction of new products to the market was considered as extremely important for independent retail grocery stores in the case of Małopolskie Voivodship, as very important for consumers and wholesalers in the case of both voivodships and for local retail chains in the case of Małopolskie Voivodship. This feature was considered to be quite important for local retail chains and companies-users in the case of Świętokrzyskie Voivodship, and for large retail chains in the case of Małopolskie Voivodship.

- More frequent than competitors product innovation was found to be extremely important for companies-users (gastronomy) in the case of Małopolskie Voivodship, very important for consumers and wholesalers in the case of both voivodships. At the same time, this feature was very important for companies-users (gastronomy) in the opinion of cooperatives from Świętokrzyskie Voivodship and for local retail chains, large retail chains and independent retail grocery stores in the case of Małopolskie Voivodship. It was considered as quite important for local retail chains in the case of Świętokrzyskie Voivodship.

- Highlighting of products against competitors' products was considered as extremely important for wholesalers in the case of both voivodships, and for consumers in the case of Świętokrzyskie Voivodship. This feature was considered as very important for local retail chains and companies-users (gastronomy) in the opinion of cooperatives from both voivodships and for independent retail grocery stores in the case of Małopolskie Voivodship. At the same time it was considered as quite important for large retail chains in the case of Małopolskie Voivodship.

■ Products' manufacturing based on the use of market research results relating to the needs and expectations of consumers, the motives for taking the decision to purchase, market trends and market structure were found as very important for companies-users (gastronomy), wholesalers, and local retail chains in the case of both voivodships and for large retail chains in the case of Małopolskie Voivodship. This feature was considered as quite important for consumers in the case of Świętokrzyskie Voivodship and for independent retail grocery stores in the case of Małopolskie Voivodship.

■ Maintaining contacts with customers during the product concept development phase was considered as very important for wholesalers, companies-users (gastronomy) and local retail chains in the case of both voivodships, for consumers in the case of Świętokrzyskie Voivodship, and for independent retail grocery stores and large retail chains in the case of Małopolskie Voivodship. This feature was also considered as extremely important for consumers in the case of Małopolskie Voivodship.

■ Maintaining contacts with customers during the implementation phase of the product concept was found to be very important for consumers, wholesalers, and companies-users (gastronomy) in the case of both voivodships and for local retail chains in the case of Małopolskie Voivodship. This feature was considered as quite important for local retail chains in the case of Świętokrzyskie Voivodship.

■ Rapid response to customer reactions to the presented offer was considered as extremely important for companies-users (gastronomy) in the case of Świętokrzyskie Voivodship and as very important for consumers, wholesalers and local retail chains in the case of both voivodships. At the same time this feature was considered as very important for companies-users (gastronomy) in the case of Małopolskie Voivodship.

4. Conclusion

As the research results show, cooperatives' representatives are aware of the validity of features of the offer for their customers in the area of the innovation and R&D. They assessed the validity of features of the offer for every kind of customers they cooperate with.

Moreover, there is not much difference in the opinion of cooperatives' representatives from both voivodships about the importance of features of the offer in the sphere of innovation and R&D for different customers. The average rating of stated assessment is similar. The only difference is in kinds of customers, be-

cause the customer portfolio of cooperatives from Małopolskie Voivodship also includes independent retail grocery stores and large retail chains.

The features of the offer in the sphere of innovation and R&D are assessed to be similar in the case of consumers and other kinds of entities in terms of the mean for all features. However, there are some slight differences among assessments of cooperatives' representatives of different kind of customers:

- for consumers from both voivodships very important are: rapid response to customer reactions to the presented offer, the degree of modernity of the product, i.e. its innovativeness, compliance with fashion trends, more frequent than competitors introduction of new products to the market, more frequent than competitors product innovation, highlighting of products against competitors' products, the motives for making purchase decisions, market trends and market structure, maintaining contacts with customers during the phase of product concept development, maintaining contacts with customers during the implementation phase of the product concept.

- for companies-users (gastronomy) from both voivodships very important are: the degree of modernity of the product, i.e. its innovativeness, compliance with fashion trends, highlighting of products against competitors' products, products' manufacturing based on the use of market research results relating to the needs and expectations of consumers, the motives for making purchase decisions, market trends and market structure, maintaining contacts with customers during the phase of product concept development, and maintaining contacts with customers during the implementation phase of the product concept.

- for wholesalers from both voivodships extremely important is highlighting of products against competitors' products. The following were found to be very important: maintaining contacts with customers during the phase of product concept development, rapid response to customer reactions to the presented offer, the degree of modernity of the product, i.e. its innovativeness, maintaining contacts with customers during the implementation phase of the product concept, compliance with fashion trends, products' manufacturing based on the use of market research results relating to the needs and expectations of consumers, more frequent than competitors product innovation, the motives for making the purchase decision, market trends and market structure, and more frequent than competitors introduction of new products to the market.

- for local retail chains from both voivodships very important are: rapid response to customer reactions to the presented offer, compliance with fashion trends, highlighting of products against competitors' products, prod-

ucts' manufacturing based on the use of market research results relating to the needs and expectations of consumers, the motives for making the purchase decision, market trends and market structure, compliance with fashion trends, maintaining contacts with customers during the phase of product concept development.

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