



**Institute of Economics
Polish Academy of Sciences**

NEW CHALLENGES IN ECONOMIC POLICY, BUSINESS, AND MANAGEMENT



Edited by

Anna Ujwary-Gil & Marta Gancarczyk

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New Challenges in Economic Policy, Business, and Management

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Anna Ujwary-Gil & Marta Gancarczyk



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Polish Academy of Sciences

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Revitalizing industrial policy through smart, micro-level and bottom-up approaches

Marta Gancarczyk¹ & Anna Ujwary-Gil²

Abstract

The purpose of this paper is to systemize the major characteristics and research areas of New Industrial Policy (NIP) and to identify the contribution of the current research monograph to these study areas. Recently, a new wave of industrial policies has been announced and called as new industrial policy by scholars and EU decision-makers. These policies are intended to address the challenges of the Fourth Industrial Revolution as well as concerns about the pace of economic growth and its uneven distribution. The new approach emphasizes place-based, micro-level and bottom-up approaches to growth-oriented industrial transformation and integrates a number of public support measures in this regard. The NIP institutions and implementation programs have already been launched and are in the experimentation phase. The more important are intense and concurrent research efforts that would both evaluate the on-going experience and enhance theoretical and methodological background. Based on the literature review, we systemize the constituent characteristics of NIP in terms of rationales, objectives, scope and governance levels, institutional framework, as well as major thematic areas and measures. When discussing these core elements, we point to i) their theoretical background, ii) their distinct nature in relation to the earlier industrial policy approaches; iii) major research issues and gaps. Next, we identify the contributions from the individual chapters in this volume and implications for further NIP-related research.

Keywords: *New Industrial Policy, industrial transformation, industrial upgrading, Industry 4.0, policy governance*

1 Marta Gancarczyk, Ph.D., Hab., Associate Professor, Department of Finance and International Economics, Institute of Economics, Finance and Management, Faculty of Management and Social Communication, Jagiellonian University, Prof. Stanislaw Lojasiewicz 4, 30-415 Krakow, Poland, marta.gancarczyk@uj.edu.pl (ORCID ID: 0000-0003-2078-9320).

2 Anna Ujwary-Gil, Ph.D., Hab., Professor of Institute of Economics, Polish Academy of Sciences, Laboratory of Process and Network Analysis, Nowy Swiat 72, 30-330 Warsaw, Poland, e-mail: ujwary@inepan.waw.pl (ORCID ID: 0000-0002-5114-7366).

1. Introduction

Throughout the history of public interventions, the relevance of industrial policy has been recognized in times of considerable social, economic, and technological challenges (Bailey et al., 2019b; Bianchi & Labory, 2019). The current claims as to industrial policy revitalization, refreshing, and coming back to policy agenda are driven by similar challenges of insufficient and uneven economic growth and technological breakthrough of the Fourth Industrial Revolution, globalization, as well as deindustrialization (Aiginger & Rodrik, 2020; Bailey et al., 2019a). The New Industrial Policy has been recognized by the researchers and policy-makers, primarily in the EU. However, new approaches to this policy area can also be observed in other countries, both the most developed, such as the USA, those rapidly growing, such as China, and in less developed regions (Schrock & Wolf-Powers, 2019; Li & Wang, 2019; Kitson, 2019). The NIP approach integrates the stock of experience in other fields of policy interventions and is holistic in nature. The new comprehensive scope of industrial policy expands from manufacturing to related services and the public sector, and from purely technological and economic upgrading towards responsible innovation and environment protection through new technologies. Moreover, it at least partly departs from top-down and nationwide and vertical programs to pick up industrial and enterprise winners or/and nationwide horizontal programs targeted at framework conditions. The new approach turns to place-based as well as micro-level, bottom-up processes, and partnerships to design and implement the policies (Aiginger & Rodrik, 2020; European Commission, 2020). In the EU, a number of strategic documents have been formulated to launch and institutionalize NIP. The most recent one, *The New Industrial Strategy for Europe* (2020) presents a strategic view of major areas, targets, measures, actions, and institutions. The NIP is then a process in action and experimentation that requires on going engagement of interdisciplinary research community at different levels of economic analysis, including micro-, mezzo-, and macroeconomic perspectives.

This volume intends to respond to the referred challenges of NIP and to contribute to the important areas of industry-related issues, providing recommendations, and further avenues for research and practice. In the first part, this volume broadens the understanding of contemporary industrial policy in regional, national, and international contexts. The second part presents the insight from management and business theory and empirical evidence as to human resource- and technology-related challenges facing the contemporary industry. The third part assumes a perspective of governing networks and interests to ensure sustainable and socially responsible enterprises and industry.

Against the above background, this chapter aims to systemize the major characteristics and research areas of New Industrial Policy (NIP) and to identify the contribution of the current research monograph to these study areas. In the following sections, we present the essence and major characteristics constituting the concept of New Industrial Policy. Then, we synthesize the contributions from this volume to better understanding of industry and industrial policy issues. Ultimately, we propose the outlook for further academic and policy-related research.

2. The characteristics of New Industrial Policy

Industrial policy is focused on increasing the competitiveness of industry to ensure sustainable growth. Recently, both the academia and EU decision-makers underline the resurgence of this policy area against technological, economic, and social challenges. We systemize this discussion, presenting the core characteristics of NIP and discussing their conceptual background, research and policy-related problems, as well as distinct features in relation to the earlier industrial policy approaches.

2.1. The rationale for New Industrial Policy

In the neoliberal economics approach, public intervention has been justified by market failure, i.e., the incidence of inefficient markets due to externalities, abusive market power, public goods, information asymmetry, and transaction cost (Bator, 1958; Cowen & Crampton, 2002). According to the general assumption of the market as operating efficiently, government is supposed to intervene incidentally only when market failure has been recognized. Acknowledging the importance of the market, the research on technology development and innovation pointed to the role of non-market governance in these processes (Stam, 2015; Morgan & Marques, 2019). These are hybrid governance modes, such as long-term contracts, alliances, networks and joint ventures that are conducive for interactions and tacit knowledge exchange (Williamson, 1998, Block et al., 2020). The premise of non-market coordination in innovation processes led to the concept of innovation systems linking relevant actors in the repetitive, network-based, and systemic interactions (Asheim et al., 2019; Ujwary-Gil, 2020). The consequence was the concept of systemic failure or network failure, in which innovation processes are impeded by the lack of some systemic elements, such as finance provision, or interaction and cooperation among the extant elements, such as research and development institutions and start-up entrepreneurs seeking new technologies (Rowan & Mawson, 2019; Block et al., 2020).

Consequently, the systemic or network failure stands for the rationale of NIP rather than market failure (Stam, 2015; Brown & Mawson, 2019; Block et al., 2019). The promotion of this justification is accompanied by a rethinking of the role of the state in industrial policy. Some of the proponents of entrepreneurial ecosystems capture this role as assisting and enhancing rather than leading the transformations – they even indicate the privatization of entrepreneurship policy (Brown & Mawson, 2019). These expressions of the government role emphasize the importance of entrepreneurial actions and processes over state interventions. They also suggest government failure in designing a planned order and policy plan, instead proposing the engagement of public–private actions (Stam, 2015; Mason & Brown, 2014).

Nevertheless, the chief approach in new industrial policy resonates with that of a smart specialization (SS) policy concept. Similar to smart specialization strategies, NIP promotes the view of a proactive state that links a planning and entrepreneurial discovery process in its actions (Foray 2019; 2020; Aiginger & Rodrik, 2020; Bailey et al., 2019a; 2019b). The calls for an “experimentalist” or “smart” state propose the processual approach made by trial and error, as well as provisional goals and their adjustments to particular conditions of time and place. Ultimately, government is seen as learning and assisting a mission-lead transition rather than the surgeon performing spot interventions against market failures (Morgan & Marques, 2019; Gancarczyk et al., 2020).

2.2. The objectives of New Industrial Policy

The aforementioned social, economic and technological challenges drive the efforts of policy-makers and researchers to design a new agenda for industry-targeted regulations and support measures. The general principles of the EU industrial policy (European Parliament, 2020) state the major objective of that policy as making European industry more competitive to secure sustainable growth and employment. To accomplish this general purpose, the specific objectives include the adjustment of industry to structural changes, the development of initiatives and undertakings, particularly those of SMEs, an environment favorable for cooperation between undertakings, the exploitation of industrial potential through innovation, research, and technological development (Article 173, Consolidated version of the of TFEU, 2012).

The latest *New Industrial Strategy for Europe* (European Commission, 2020) emphasizes three major directions that include a globally competitive industry, an industry leading to climate-neutrality, and industry enhancing Europe’s digitalization. These directions indicate additional purpose, besides the ones of industrial productivity and progressive transformation, namely, the

purpose of environmentally responsible industry that acknowledges societal expectations (Aiginger & Rodrik, 2020).

2.3. The scope and governance levels

In the contemporary industrial policy, two major approaches have been intertwining. The first one assumed vertical and selective interventions to pick up winners, i.e. particular industries or national champions. The second one has been horizontal and focused on improving the overall environment for business activity, in the form of legal protection of competition, promotion of skills and education, as well as the development of R&D and tangible infrastructures (Bailey et al., 2019; European Parliament, 2020). The NIP approach turns to vertical orientation. However, it is not directed at picking winners, but on prioritizing some business domains and areas of infrastructure in a complex way, e.g., promoting transformation through cross-sectoral and inter-industrial convergence, accompanied by R&D support (Fagerberg & Hutschenreiter, 2019; Janssen & Frenken, 2019).

In the traditional approach, industrial policy has been designed and implemented top-down, by central government programs. NIP, following the SS concept, promotes a multi-scalar approach, starting from the top-down design to implementation and refinements with participation of regional and local governments, as well as other relevant actors, including businesses, academia, and societal stakeholders (Foray, 2014; 2015; 2020; McCann & Ortega-Argilés, 2015). Matching different levels of policy setting, as well as top-down and bottom up decision-making, NIP seeks to avoid threats, such as ignoring place-based and idiosyncratic needs of territories and communities from top-down; or incumbent stakeholder pressure preventing transformation and local myopia from bottom-up (Kitson, 2019; Fagerberg & Hutschenreiter, 2019).

The primary scope of industrial policies has been traditionally on manufacturing (Bianchi & Labory, 2019). Nevertheless, the importance of the service sector in the contemporary economy, as well as cross-sectoral and cross-industrial transformations, e.g., products turning to services and vice versa, product-service bundles, expand that scope in NIP to comprise manufacturing, services, and even agriculture (Janssen & Frenken, 2019; Aiginger & Rodrik, 2020; European Commission, 2020). Consequently, NIP assumes the expanded scope of entities, involving all the players in the value chain. These players might be large firms and SMEs, as well as clusters and ecosystems inserted in global value chains (Barzotto et al., 2019).

2.4. Institutional framework

We consider the institutional framework of NIP as encompassing formal laws and regulations, as well as organizations that act based on these rules (Grillitsch, 2014). As indicated above, national government institutions have been primarily in charge of industrial policy, while NIP emphasizes an additional place-based approach (Kitson, 2019). Thus, it acknowledges the uniqueness of particular territories, inviting regional and local governments to join the efforts. Other relevant institutions involve academia, business organizations, as well as clusters, technology parks, and other organizational forms of technology transfer and enterprise support (Asheim et al., 2019).

At the EU level, the general rules of industrial policy have been stated in a number of programmatic documents, such as the communications *For a European Industrial Renaissance*, 2014, *Digitising European Industry – Reaping the full benefits of a Digital Single Market*, 2016, and *Stronger European Industry for Growth and Economic Recovery – Industrial Policy Communication Update*, 2012. The latest strategy of NIP (European Commission, 2020) identifies the extant legal arrangements and organizations responsible for major objectives and thematic areas. Moreover, it indicates upcoming regulations and new bodies tailored to particular areas, such as Just Transition Platform offering technical and advisory support for carbon-intensive regions and industries, or strategy for smart sector integration.

2.5. Major thematic areas and measures

Given the scope and levels, NIP is holistic in nature and uses bundles of thematic areas, detailed related policies, and measures to accomplish its objectives (Bailey et al., 2019a; 2019b). Particularly, progressive structural change or transformation through new technologies and business models is emphasized to increase industry international competitiveness (c.f., Ujwary-Gil & Potoczek, 2020).

The crucial policy area research and *regional innovation and smart specialization strategies (RIS3)*, predominantly designed and implemented by regions (Morgan & Marques, 2019). Smart specialization (SS) is the most developed and comprehensive concept of NIP. RIS3 assumes prioritizing resources and directions towards concurrent exploitation of extant industrial competences and exploration of new prospective domains through entrepreneurial discovery (McCann & Ortega-Argilés, 2015). SS focuses on regional industrial transformation and encourages sets of objectives and measures dedicated to the transformation process (Foray, 2013; 2014). The experience in design and implementation of SS has been accumulating. Nevertheless, it is difficult to synthesize universally due to the uniqueness of each regional context

(Lane, 2019). The profiling and taxonomical methods to identify a number of alternative modes of design and implementation are more suitable than one universal model. One of the crucial issues in this regard is the evaluation of RIS3, which needs to assume long-term and medium-term perspectives to capture the results expected at different stages of this policy realization (Morgan & Marques, 2019; Lane, 2019). Ultimately, the RIS3 performance and outcomes are still research in progress, since ex-post evaluations of the SS projects are chiefly ahead of us (Morgan & Marques, 2019).

Regional industrial transformation is a thematic area and has a concept related to SS through industrial structural change as a focus (Bianchi & Lasbory, 2019). At the same time, it is discrete in its theoretical evolutionary background, referring to path dependence and regional industrial path trajectories (Hassink et al., 2019; Gong & Hassin, 2019; Isaksen et al., 2019; Asheim, 2019). In this concept, innovative activities are relevant, leading to the extension, renewal, exhaustion, or creation of regional industrial paths. Industrial transformation then denotes structural changes in industry and related innovation systems (Hassink et al., 2019; Grillitsch et al., 2018; Isaksen et al., 2019). The adjacent major thematic areas are *the Fourth Industrial Revolution and industry 4.0, research and development activities and entrepreneurial discovery* to create potential and implement innovation-led changes. Entrepreneurial discovery denotes both the innovative activity of entrepreneurs and the approach of policy-makers and relevant actors in accomplishing regional transformation. The EU innovation policy passed a way from creating framework conditions for innovation through programs supporting R&D activity, to supporting entrepreneurial activity that is instrumental for commercialization, i.e. making value of R&D investment and related knowledge (Foray, 2013; 2014; 2017; 2020). Entrepreneurial discovery as a policy-makers' approach consists of experimentation, information exchange, and debating to jointly implement policies (Foray, 2019; 2020). In a nutshell, it was also called bottom-up and place-based policy design and implementation.

Progressive transformation is often accomplished through *upgrading, i.e., advancing in value chains* towards higher value-adding activities (Gancarczyk & Gancarczyk, 2016). Since transformative processes through breakthrough innovation are rarely purely local, upgrading of enterprises and clusters needs to be considered in the context of global value chains (GVCs) (Gereffi & Lee, 2016; Gancarczyk et al., 2018; Humphrey & Schmitz, 2002; Pietrobelli & Rabellotti, 2011; Aslesen & Harirchi, 2015; Sturgeon et al., 2008). Upgrading and transformation can be accelerated by the adoption of Key Enabling Technologies (Ciffolilli & Muscio, 2018). The latter, paired with extant mature industries, can increase productivity and lead to the convergence towards new, emerging industries, such as biopharma, digital, and experience industries. Within industrial transformations, particularly

emphasized research and policy areas are socially responsible ecological and digital transitions (EU Commission, 2020).

To reach the transformations at the intersections of sectors and industries, it is necessary to create collaborative environments. These are represented by *industrial clusters as well as industrial and entrepreneurial ecosystems* (EU Commission, 2020; Götz, 2020b; 2020c; Gancarczyk, 2019; Mason & Brown, 2014; Stam, 2015; Lisowska, 2015). Cluster progressive evolution is often identified with localized industrial change. This change affects the entire industrial system of a particular territory, be it a country, a region, or a city (Barzotto et al., 2019). Since upgrading is largely technology-driven and technology has global scope, the innovation for upgrading and resulting advancement of the value chain position should be regarded in the context of GVCs (Götz, 2020a; Gancarczyk & Gancarczyk, 2018; Barzotto et al., 2019).

Challenged by the objective of transformation, NIP departs from selective, *ad hoc* policy interventions with individual measures against market failures. Instead, it adopts bundles of policies, measures, and related projects that comprehensively promote structural change. The policies contributing to and related with NIP are science, technology and innovation policies (STI), antitrust and competition policy, trade policy, regional policy, as well as internal market, procurement, and innovation policies (Aiginger & Rodrik, 2020).

Consequently, NIP applies a critical mass of related measures that stem from virtually all the above policies. In the case of the EU, these measures are included in a number of initiatives, such as cohesion policy, Horizon 2020, the Connecting Europe Facility, the EU program for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME). Additionally, the Investment Plan for Europe and the European Fund for Strategic Investments (EFSI) target, predominantly, SMEs, and innovation with the use of public and private funds (European Parliament, 2020).

3. Contributions

The first part of this volume broadens the understanding of contemporary industrial policy in local, regional, national, and international contexts. The chapter by Wojnicka-Sycz (2020) undertakes one of the most important challenges in RIS3, i.e. the evaluation of the impact of regional SS industries on the development of Polish regions. Based on the spatial panel models for 2012–2017, she reveals the positive impact of SS industries' employment dynamics on regional GDP per capita. The chapter responds to the research gap in a direct measurement of how SS areas affect regional development. The results provide the rationale for policy-makers to pursue these strategies

further. The chapter contributes to regional New Industrial Policy by proving the efficiency of SS in strengthening regional performance.

Factors and barriers to the development of smart mobility in medium-sized Polish cities are the focus of the chapter by Kachniewska (2020). The author applies a comprehensive set of methods to tackle this issue and identifies the conditions for smart mobility, drawing primarily on expert opinions. The results enable a natural generalization of the identified determinants to the similar context of Polish towns, the more important that the research on medium cities is much rarer than studies on metropolises. This contribution belongs to the research streams of city governance and data-based services, which are closely connected to and dependent on industrial digital transformation. Moreover, smart mobility addresses the objective of environmental protection, one of the crucial targets of NIP.

Godlewska-Dzioboń (2020) performs international comparisons between Central and Eastern European Countries in 2020–2018. Particularly, she focuses on the sectoral transformation of the employment structure in these countries. Besides the important observations of spatial dynamics in sectoral structures, the chapter points to the increased importance of services relative to manufacturing in contemporary structural transformations. Thus, it justifies the expanded scope of New Industrial Policy that encompasses not only industry, recently refreshed with 4.0 Revolution, but also services, particularly the digital ones.

The chapter by Czech (2020) identifies the impact of global debt on the national amounts outstanding of credit default swap contracts (CDS) in non-financial institutions. She finds the dynamics of the CDS notional amounts outstanding in response to global household indebtedness and total non-financial sector indebtedness in domestic banks. This contribution brings valuable practical insights about the core and dynamics of CDS and their usefulness in alleviating risks in international exchange. We find this input particularly relevant for industries and enterprises operating in global value chains.

Widera (2020) performs a spatial analysis of the induced population potential of the communes in the Opolska region in 2000 and 2018. The econometric analysis revealed both the own potential of the communes and the interactions with neighboring communes to develop this potential. These findings are important to theorize about the bottom-level sources of territorial units' potential, both internal and those stemming from spatial interactions. We find these conclusions relevant to understand local-level origins of regional transformations, as well as interdependencies among local territorial units.

The next two parts of this volume present micro-level and bottom-up contexts for industrial policy. Particularly, these are the insights from

management and business research and from the research on governing various stakeholder interests and networks.

In the second part, based on management and business theory and empirical evidence, the authors discuss human resource and technological challenges faced by the contemporary industry.

Potoczek (2020) performs a bibliometric research to recognize the advancement of the process approach in organizations. She finds the research on process improvement as emerging. The major research community in that area belongs to the IT field, while management researchers are still a minor group. The author recommends the increased interest from the management field as conducive to the 4.0 transformation of organizational processes. These results provide policy-relevant input to the understanding of how academic research tackles digital transformation in organizational processes.

The chapter by Igielski (2020) uses a survey among a sample of large enterprise senior managers headquartered in Poland to check whether and how they develop employee skills for the challenges of Industry 4.0. The results are pessimistic since they reveal the lack of adaptive and developmental actions in this regard. Nevertheless, there is also a positive sign, namely the awareness of the challenges posed by the 4.0 revolution. Thus, the chapter is valuable for the recommendations as to competence development in industrial transition to the digital economy.

Flak (2020) presents an interesting test for the system of organizational terms as to its usefulness in the practice of motivating people and in a dedicated software. Based on a research experiment in real-life business settings, the author proves the applicability of theory-driven organizational terms in software applications supporting managers in their motivating functions. The chapter contributes important observations as to the interrelations among managerial and technological resources in motivating employees.

Sztorc (2020) investigates lean management tools at hotels in Poland, based on a large sample of hotel representatives. The results are helpful in understanding the types of lean management tools, as well as their major targets in the researched organizations. The input of the study rests in filling the research gap as to the particular tools of lean management applied in the hotel industry to improve services and processes. The focus of this chapter on a particular industry provides a relevant basis for further application and upgrading of this service sector.

The chapter by Mazurkiewicz (2020) offers an assessment of the impact of national culture on career orientation and career values among Polish and Chinese students of economics. Surprisingly, the value system does not differ much between the two national samples, despite the distinct characteristics of the two national cultures, according to Hofstede's method. Consequently,

the author assumes national culture as moderator of career values rather than their determinant. These results provide a contribution to the understanding of job motivations among future corporate employees, a critical determinant of all industrial transitions.

Kowalik (2020) investigates the economic benefits perceived by student participants of scientific projects. Based on the survey, the author reveals students' recognition of scientific projects as bringing economic effects. The study offers practical implications for young people engaging in research activities, as well as for research policy that might acknowledge additional important outcomes, besides purely scientific objectives.

The third part discusses how governing networks and interests can ensure sustainable and socially responsible industries and enterprises.

Sectoral and industrial collaborations are supposed to enhance industrial convergence (EOCIC, 2019). In this vein, Lis (2020) focuses on collaborative attitudes in clusters and technological parks. Cluster organizations are established to rip the localization and agglomeration economies, as well as synergies from cooperative links. Despite some history of operations, the surveyed Polish cluster initiatives and technology parks still reveal low development of enterprise cooperation. The author suggests self-evaluation of management and participants of the researched organizations to understand the accomplished level of collaboration and derive practical implications. This contribution is important to understand the performance of some organizational measures of industrial policy and their real input to industrial transformation.

The chapter by Kowalczyk (2020) investigates sociocultural conditions of CSR-practices in the construction industry of selected European countries. Based on a survey with a large convenience sample, the author confirms the strength of stakeholder pressure on CSR practice as well as the mediating role of company culture in this relationship. At the same time, country differences were indicated as significant for CSR practice and worth further explanation of its variance. This study is valuable for the explanation of interests and stakeholder pressure affecting a particular industry, thus determining the development conditions of that industry.

Another industry-specific study has been proposed by Kurzak-Mabrouk (2020), who focuses on food businesses. This chapter addresses the critical strategic direction of NIP that refers to sustainable and responsible growth with regard to environmental protection. The author performed the interviews with top and middle managers of a large representative sample of Polish food companies. The findings are optimistic, since the majority of companies undertake the efforts towards comprehensive sustainable development strategies voluntarily, and not only due to legal enforcement. Still, the researched enterprises do not fully apply these strategies as yet.

Resonating with the study by Lis (2020), Flieger (2020) identifies network types according to the collaboration maturity level in a local government unit. The research on collaborative networks in public organizations still remains unique. Therefore, this study fills the research gap. The author uses a case-based approach to identify the network features that change according to the maturity level of relationships. The findings are useful for the practice of developing collaboration in local governments and contribute to our understanding of the context for industrial development.

4. Conclusion and implications for further research

Industrial policy has been recently broadened by smart, place-based, bottom-up, and micro-level approaches to industrial transformations towards competitiveness. The contributions gathered in this volume combine these new approaches with macroeconomic and international perspectives. Matching these two aspects is necessary to meet the New Industrial Policy purpose and specific objectives. Therefore, both dimensions need further investigation. Below, we present the prospects for further research in the referred areas as stemming from each part of the current volume.

In *the first part*, we find a number of thematic areas and methodologies proposed for the future investigation of local, regional, and international development policies. In the area of policy evaluation, Wojnicka-Sycz (2020) recommends the extension from the ultimate GDP outcomes towards the intermediate effects of smart specializations, i.e. R&D and innovation performance. Moreover, she seeks international comparisons of these effects, particularly in other EU countries. In depth, regional-level data are also needed to investigate more precisely the industrial scope of smart specializations. On-going evaluations focus largely on the implementation phase and the indirect, mediating effects of industrial strategies. In this vein, Kachniewska (2020) proposes further important research in the implementation strategies and methodologies towards smart mobility in medium cities. Widera (2020) sets out an interesting research perspective on internal regional dynamics and growth distribution, to identify functional areas and regional growth poles.

The international context of structural economic changes and industrial growth has been the focus of Godlewska-Dzioboń (2020) and Czech (2020). After evaluating sectoral structural dynamics, Godlewska-Dzioboń (2020) recommends the performance assessment of individual economic sectors in Central and Eastern European countries, as well as the causes of long-term employment dynamics in these settings. Czech (2020) calls for further studies on risk management in globalized economic exchange. This recommendation

is compelling, even in the case of localized industries such as clusters, since they are also inserted in global value chains.

In order to plan for industrial transformation and competitiveness, it is necessary to investigate further the micro-level transitions in management and business studies. Thus, *the second part* also sets out the agenda for future research, particularly in the area of matching employee competences, management methods, and digital technologies.

The chapter by Potoczek (2020) forms a basis for further specification of research questions and systematic literature reviews in business process management. Another research direction might be practically oriented studies that more tightly integrate management methods with 4.0 tools in organizational processes. The chapter by Igielski (2020) calls for the replication of the performed research on a random sample to enable robust generalization as to the development of employee competences towards digital transformations. The study by Flak (2020) reveals unique possibilities of applying software solutions in tackling soft management issues, such as those related to motivating people, recruitment or organizational culture diagnosis and management. The contribution by Sztorc (2020) encourages further in-depth studies on the causes and outcomes of particular lean management tools for economic performance in the hotel industry.

Career orientation of students as future employees was explored by Mazurkiewicz (2020) in the context of national cultures. According to the author, it would be relevant to expand the research to a larger research sample, diverse regional settings, and to acknowledge a wider range of factors influencing student career orientation. The interesting findings of Kowalik (2020) about students' perceptions of economic benefits from participation in scientific projects might be further explored with a large and random sample, to guide both students and policy makers in the area of R&D.

The design and implementation of industrial policies can only be successful with the comprehensive participation of stakeholders. Therefore, governing interests and networks is a prospective and fruitful area for further studies, as highlighted in *the third part* of this volume.

Lis (2020) proposes future research to identify relationships among motivation, efficiency and commitment in networking, with the use of quantitative studies and a representative, random group of business environment organizations. Similarly, based on the results of his explorative study of a local government's networking, Flieger (2020) intends to apply a quantitative measurement of local government networks and hypotheses testing. With reference to both studies, we would also recommend the investigation of how different levels of collaborations in clusters, technology

parks, and local governments translate into the performance of the enterprises and public organizations involved.

Synthesizing his research on CSR practices in European companies, Kowalczyk (2020) proposes the continuation of the investigations to explore the relationships between these practices and enterprise performance as well as national cultures. The recommendations to check causalities between sustainable growth practices and enterprise performance might also be relevant as a follow-up of the study in the food industry by Kurzak-Mabrouk (2020). A prospective avenue for future studies would be to test empirically the author's model of implementing sustainable growth in relation to economic outcomes.

This chapter has systemized the major characteristics of New Industrial Policy, pointing to its theoretical foundations, distinct nature, and major research areas. Ultimately, it has discussed the contributions from the chapters in this volume, both to their specific research areas and to the on-going challenges of industrial policy. We are in the emerging but rapidly growing phase of revitalizing industrial policy, where research has to accelerate to come up with empirical advancement. Even more importantly, we expect this research to demonstrate explanatory and predictive capacity, thus enhancing practice. We believe that this volume provides relevant support to these on-going efforts.

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Biographical notes

Marta Gancarczyk – (Ph.D., Hab.), Associate Professor at the Institute of Economics, Finance and Management, Jagiellonian University in Krakow, Poland. Her research, publication and consulting activities focus on entrepreneurship, firm growth, technology management and commercialization, industrial clusters, and public policy for small and medium-sized enterprises. She is an Associate Editor of the international scientific journal entitled *Journal of Entrepreneurship, Management and Innovation (JEMI)*, and a Member of the Editorial Advisory Board of the *Journal of Organizational Change Management*.

Anna Ujwary-Gil – (Ph.D., Hab.) is a Professor at Institute of Economics, Polish Academy of Sciences (Laboratory of Process and Network Analysis) in Warsaw, Poland, where she is also a director of two MBA programs. She earned her Ph.D. in economics and management from the Warsaw School of Economics, Poland. She is the Editor-in-Chief of the international and scientific journal named *Journal of Entrepreneurship, Management and Innovation (JEMI)*. She is also the founder and president of the *Cognitione Foundation for the Dissemination of Knowledge and Science*. Her research interests include organizational network analysis, knowledge management, intellectual capital, resource-based views, and dynamic approaches to organization and management.

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Chapter 1.
Economic policy challenges

Smart specializations and regional development in Poland

*Elżbieta Wojnicka-Sycz*¹

Abstract

The article aims to evaluate the impact of industries indicated as smart specializations (SS) on regional development in Poland. Its purpose is to check if the smart specialization policy, designed as a concentration and diffusion based one, achieves the desired effects. It is done using spatial panel models for the years 2012–2017 for Polish voivodeships and by literature review. The analysis showed a positive impact on GDP per capita of the increase in employment in industries connected with regional smart specialization priority areas. The results may be used by politicians to justify further application of the smart specialization concept in regional development and innovation policy. The article responds to the lack of studies on the relation between smart specialization and regional development that would be based on variables directly reflecting SS areas.

Keywords: *smart specializations, regional development, spatial panel econometrics, regional innovation policy*

1. Introduction

Smart specializations (SS) have been selected by administrative regions in the EU for the needs of regional innovation smart specialization strategies (RIS3) that form the 3rd generation of them. In some of the regions, such as Pomorskie in Poland or Upper Austria, smart specialization priority areas have only complemented the existing regional innovation strategies². They represent bundles of economic sectors and/or activities/technologies in which regions specialize and hence have achieved there a critical mass in terms of business activity or constitute emerging innovative areas with a concentration

¹ Elżbieta Wojnicka-Sycz, Ph.D., Hab., Associate Professor, University of Gdansk, Bażyńskiego 8, 80-309 Gdańsk, Poland; Gdansk University of Technology, Narutowicza 11/12, 80-233 Gdańsk, Poland, e-mail: elzbieta.wojnicka-sycz@ug.edu.pl (ORCID ID: 0000-0002-0016-5580).

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² Documents placed on <https://s3platform.jrc.ec.europa.eu>, interviews in Marshall Office of Pomorskie Voivodeship.

of R&D activity. The smart specialization industries or activities/technologies are assumed to be characterized by strong research and development and innovation activity (R&D&I) in the region, cooperation with science, international competitiveness and the potential of a related diversification into new niche industries thanks to entrepreneurial discovery. These areas may receive support from regional resources under the Structural Funds for research. Their selection results from the need to prioritize and focus resources on research in areas that in a given region can bring the best results in terms of implementing innovative and internationally competitive solutions, which results from the existing structure and development of the regions. In addition, areas that may be promising for regions in the future are identified as part of the smart specialization strategy. The idea of the Strategy for smart specializations was born during the economic crisis of 2008 and reflected the approach to supporting innovative development in conditions of limited financial resources. Therefore, the support is to concern the most productive areas that give the best chances to stimulate the development of innovative regions thanks to implemented, internationally competitive innovations and connections that the supported areas will create with other regional sectors.

The aim of the article is to check whether smart specializations actually translate into regional development based on analyses carried out for Poland.

The research hypothesis in the performed analysis was that, in accordance with the objectives of the smart specialization policy, the development of economic domains on NACE divisions level selected in regions and connected with smart specialization priority areas should translate into an increase in Gross Domestic Product per capita.

The limitation of this approach is that the areas indicated by regions do not embrace the whole related NACE divisions. However, this approach had to be used due to the availability of statistical data on NACE divisions. Moreover, the regions themselves often have difficulties in indicating firms belonging to smart specialization areas. It leads to additional research done on the basis of Websites of firms chosen according to keywords connected with SS areas (Podkarpackie voivodeship) or analysis on the basis of NACE classes indicated by the firms constituting consortia of smart specializations (Pomorskie voivodeship) (Wojnicka-Sycz, Sliż, & Sycz, 2018; Klimeczak et al., 2017). However, assuming growth spill-over effects from the growth of SS companies of a certain NACE class or classes, their better economic performance should translate into better performance of the whole NACE division. We assume that the activities indicated as smart specializations even before the implementation of this policy should be of a pro-growth character, as regions were to choose the most competitive areas as SS. The analysis in the article checks if these priority areas really translate into economic

development also during time of the enforcement of this policy. The base year in the analysis is 2012, which is before enforcement of SS strategies. Hence, the analysis checks both correct indications of SS areas in terms of their pro-growth character as well as the effects of the policies in regions.

The article presents the concept of smart specializations and theoretical foundations, reflecting the connection of this concept with regional development as well as an overview of studies on the connection between SS areas and economic development. Then, it is checked whether smart specializations translate into regional development based on econometric analyses of the impact of the presence of SS industries on Gross Domestic Product (GDP) per capita in Polish provinces. The SS areas are reflected by the number employed in industries on NACE divisions level connected with specific regional SS priority areas. The research methods used are a review of the literature, source documents, as well as econometric analyses based on statistical data.

2. Literature background

The logic of smart specialization strategies is as follows: 1) regions cannot be good in all fields of science, technology, and innovation; 2) they must promote their unique knowledge base and be better at it than other regions. In these areas, they should try to invent new products/market niches and thus achieve related diversity, for example, economic diversification resulting from the combination of local expertise and resources in innovation based on existing strengths (OECD, 2013). In addition, the strategy of smart specialization should lead to the technological modernization of existing industry, including the development of specific applications of new technology in a given traditional sector – for example, the Finnish pulp and paper industry perceives nanotechnology as a source of valuable innovations (EC JRC, 2012).

Public funding should eliminate the development traps of individual regions, including stimulating smart specialization strategies. The rationale for the concept of smart specialization is those territories cannot be involved in research and development of all fields due to limited resources. Thus, territorial specialization in the most promising innovative domains is highly desirable. Territories should support their unique knowledge base as a source of innovation and competitiveness. In addition, the concept of smart specialization seeks to take advantage of economies of scale and spill-over effects of knowledge in territories. In other words, the size of the sector and the appropriate strength of links between entities are necessary to take full advantage of the opportunities offered by smart specialization (Novosák et al., 2013). Smart specialization policies must be rooted in local conditions and

guarantee access to external knowledge through strong and vital links with the supra-regional environment (Capello & Lenzi, 2013).

According to McCann and Ortega-Argilés (2016), the basic argument of the smart specialization strategies is that policy resources must be spent on those activities, technologies, or sectors where a region has the most realistic chances to develop internationally competitive products. This approach requires that many of these activities are already embedded in the region's existing industrial fabric and that many local actors are engaged in the policy design and delivery process. Markkula and Kune (2015) state that it is the active orchestration of the regional ecosystem around concepts such as knowledge co-creation and exploitation, opportunity exploration, or capacity building that makes a "smart region." According to them, smartness is enhanced by a well-orchestrated regional innovation ecosystem with a strong "smart specialization strategy".

The concept of "smart specialization" means a new generation of research and innovation policy in the EU that goes beyond classical investment in research and technology and the generic creation of innovation potential (Foray, David, & Hall, 2009). Before RIS3, the innovation policy of the EU did not have any strategic character in the form of setting priority areas. Smart specialization represents a departure from the horizontal type of innovation policy that has been prevalent in the EU for many years (Foray, Morgan, & Radošević, 2017). Traditionally a regional strategy for innovation consists chiefly of horizontal and neutral measures to improve general framework conditions and capabilities. Smart specialization policy is focused on a more vertical and non-neutral logic of intervention. It is a process of identification and selection of priority areas that could be favored within the framework of the regional policy (Foray & Goenega, 2013). Hence, RIS3 policy may be perceived as a regional development policy based on knowledge concentration and diffusion. However, support for regional smart specializations (RSS) is justified by the potential of growth spill-over effects from SS industries due to the inter-industrial relations.

Smart specialization is a type of place-based approach that takes into account interactions between institutions and geography as crucial for development. It builds on a systems way of thinking about growth, innovation, and entrepreneurship. It focuses on regional endowments but also looks into the position of a region in international value chains (Thissen, van Oort, Diodato, & Ruijs, 2014). The smart specialization approach may be considered a link between regional development policies and innovation policies (Gonzalez-Lopez, Asheim, & del Carmen Sánchez-Carreira, 2019). Originally, the concept of SS was to strengthen EU competitiveness in relation to the USA, which was perceived as weak due to lower prioritization of efforts

and resources. SS has been linked to the EU regional policy as a condition to access EU funds for R&D (see Popa, 2016).

According to Foray, Morgan, and Radosevic (2017), RIS3 lies at the intersection of research and innovation, industrial and cohesion policies, as well as a new policy of European value chains and networking, in addition to grand policy challenges (like sustainable development) and is designed to be a tool of these policies. Corpakis (2020) sees the need for better coordination of SS policy and cohesion policy financed by structural funds, which could stimulate regional development through an entrepreneurial discovery process reflecting a systemic paradigm and allowing for better usage of funds for innovation purposes.

The smart specialization concept stresses the role of knowledge and innovation as stimulants of regional growth and development. It emphasizes the role of place-based policy strategies based on unique regional characteristics as being different from strategies replicating the successful policies of other regions (McCann & Ortega- Argilés, 2013; Moodysson, Tripl, & Zukauskaitė, 2015). McCann, Ortega- Argilés, and Foray (2015) define SS policy as a policy approach to enhance the economic performance of European regions. It puts innovative entrepreneurship at the center of the regional economic development agenda.

According to Haukioja, Kaivo-oja, Karppinen, and Vähäsantanen (2018), the S3 is connected with such determinants of regional competitiveness as innovation and creativity, agglomeration economics, foreign direct investment, clusters, specialization and concentration, networks and transportation costs, education and research, size and available resources, institutions and social capital, infrastructure, and human capital. Moodysson, Tripl, and Zukauskaitė (2015) present SS policy as a way to stimulate regional development through path renewal and the creation of a new path of development. It is based on exploiting regional strengths and the industrial renewal of existing competitive industries with the usage of new technologies and by entrepreneurial experimentation, taking into account extra-regional influences. It changes the regional and innovation policy based on clusters into policy based on systems of innovation that emphasize knowledge flows. The authors give the example of the Scania region that moved from traditional clusters policy and identified three priority areas with potential for new path development: personal health, smart materials, and smart and sustainable cities. These areas are perceived as promising in terms of the scale, scope and possibility of knowledge spillovers, as well as being distinctive and unique and so resembling the idea of SS. Písar, Hunady, and Durčeková (2018) found that higher R&D in regions of the Czech Republic and Slovakia was correlated with increased labor productivity and, hence, S3 can induce labor productivity.

The assumptions that SS can stimulate economic development derive from the following characteristics of this approach (see Foray & Goenega, 2013; Foray, Morgan, & Radosevic, 2017; Wojnicka-Sycz, Kaczyński, & Sycz, 2020; Asheim, 2019):

- choosing priorities that have a competitive and comparative advantage in a country and internationally – that are growth poles in certain regions and are concentrated in these regions;
- basing on innovation and R&D activity being determinants of economic growth according to neoclassical and new growth theory, that may be concentrated in emergent economic areas;
- using knowledge flows, allowing for positive externalities according to the innovation system approach.

Indications regarding the necessity to build critical mass and diffusion of growth from innovative sectors contained in RIS3 are correct from the point of view of the theory of spatial management. New economic geography (NEG) draws attention to agglomeration processes and economies of scale generated by specialization. Paul Krugman (1995) has shown that a country can be endogenously diversified into an industrialized center and agricultural periphery. Companies choose locations with maximum market potential, defined as market access, covering both the purchasing power of all markets on which they can sell and the distance of these markets. This implies cumulative causality – companies want to be located around large markets, and large markets are where there are a lot of companies. This means self-accelerating regional growth or decline. Krugman believes that while at the state level, rapid development on a “big push” basis is impossible, it can be achieved at the regional level. External effects are one of the reasons for the existence of large cities, as well as the concentration of industries in a geographical space.

Polarization of R&D activity that is assumed by the strategy of smart specializations is necessary, not only because of the limited resources available for its support but also because of the possibilities of individual regions to obtain a return on investment in R&D (Camagni & Capello, 2013). It is also assumed that as a result of the increase of R&D and innovation activity in smart specializations, the development of entire regions will be stimulated due to inter-industrial relationships, knowledge diffusion and spill-over effects. This is in line with theories of unbalanced regional development, such as the theory of growth poles spreading innovation and growth in their economic space formulated by Perroux and Hirschman’s theory of polarization and growth diffusion from innovative centers. In addition, Friedman’s center-periphery theory indicates that the hierarchy of large and medium cities is needed to achieve spread of innovations (Perroux, 1970; Calafati, 2000; Sardadvar, 2011; Friedman & Weaver, 1979). The territorial growth pole model as

a system of development factors constructed for Poland also showed that in order to achieve good results in terms of economic growth and its spread it is necessary to achieve a critical mass of various development factors in a given territory. This creates conditions for development based on industries active in R&D and innovation (Wojnicka-Sycz, 2013).

In the polarization theories of Perroux, Myrdal (cumulative causation theory), and Hirschman, production factors are assumed to be non-homogeneous, markets are imperfect, the price mechanism is distorted by externalities and economies of scale. Deviations from equilibrium are not corrected by opposing effects, but rather begin a cumulative growth or decline process with complex positive or negative feedback, accumulating in a growth process whose direction is indefinite. From a spatial point of view, these feedbacks cause spreading and leaching effects by transferring impulses from one region to another. Leading and lagging regions are created in the spatial structure as a result of this growth process. Proponents of the polarization theory argued that not only economic but also social, cultural, and institutional factors explain why some regions thrive while others lag behind (Stough, Stimson, & Nijkamp, 2011). The theories of unbalanced growth mostly refer to the works of J. Schumpeter in terms of creative destruction, which, by cleaning the economy of inefficient elements, causes further development.

Economic development is a cyclical process induced by development factors, the effects of which are accumulated in the economy (Perroux, 1970). Economic activity then shows a tendency to spatial concentration, creating clusters of companies and institutions, which cause diversification of development in a geographical space. F. Perroux saw the imperfection of the variables used to measure economic growth in the form of national product, consumption, income, or sectoral structure, because according to him, they do not include, among others, the social costs at which they are obtained. Perroux (1970) believed that territorial agglomeration provides additional impetus for economic activity. He pointed out that the intensification of economic activity occurs as a result of proximity and interpersonal contacts, inducing an increase in consumer demand and an increase in income. He also believed that the growth pole had an impact on the formation of the class of entrepreneurs, skilled labor, work teams, increasing interregional differences and the interaction of other poles with the original.

According to Perroux, economic progress depends on innovation and the diffusion of innovation. As an innovation, he understood a change in production techniques resulting in new products and lower costs. Innovations spread horizontally to other companies in innovative industries or vertically in related industries. Perroux (1970) saw the innovative process as collective and cooperative in terms of methods, entities, and results. Innovations are the

result of joint efforts of large economic groups rather than individuals. They appear mainly in an oligopolistic environment, not in perfect competition, that is in the conditions of interventionism, not a free market. This is due to a lack of research funding for small businesses and the difficulty of appropriating the benefits of innovation. According to Perroux, incentives for innovation are mainly due to the oligopoly's fear of rivals and the monopoly fear of potential rivals. Innovations and their diffusion depend on a combination of monopolistic and competitive forces, and apart from market prices, also important for innovation processes are the rules of the game regarding relations between companies and the role of the state as an innovator or guarantor of diffusion of innovation.

Hirschman emphasized that the region is a system consisting of entities between which interactions occur. He emphasized innovation as a source of economic change (Calafati, 2000). Unlike Schumpeter, he did not underestimate the importance of collective innovation, which is created both by cooperating entities and in the form of development projects. He showed that public development projects are the primary source of evolutionary change in the economy, in particular support for research and development in the regional and state policies as well as infrastructural investments. Systems can be directly changed by their processes, and a change in the structure of the system causes a change in its processes, resulting in a cumulative causality that constantly changes the system and its processes. Hirschman sees evolution as a continuous process driven by innovation (Calafati, 2000).

The center-periphery theory of Friedman goes beyond the cross-sectoral distribution of resources from the theory of growth poles to deal with real problems of regional development in a geographical space. Core regions emerged in response to market conditions, without significant external help from central level politicians, apart from attention to macroeconomic variables (Friedman & Weaver, 1979). Friedman assumes that economic growth would appear if a developed and functional hierarchy of large and smaller cities was created, and the diffusion of growth would be proportional to the size of the agglomeration. This hierarchy of cities is a way to connect the periphery with the center – the core. Within this hierarchy, innovation diffuses from the center to the periphery in the form of innovation waves (Friedman & Weaver, 1979).

In the Web of Science database, 250 articles with smart specialization in the title are present and 72 of them are connected to some extent with the topic of economic development and most of them originated in the years 2019 (24) and 2018 (14). However, none of them checks if the bundles of industries/activities indicated as smart specializations have an impact on economic development. The existing articles assume what the effects of smart specializations should be in terms of economic development or what

the impact assessment of SS should be like but without taking into account variables directly reflecting SS areas. Varga, Sebestyén, Szabó, and Szerb (2020) assessed entrepreneurship and knowledge networks in regions using the GMR-Europe (geographic, macro, and regional) model, which could indicate the success of S3 in the regions.

Esposito, Abbott, and Juliano (2019) suggest using for the modeling of the economic impact of smart specialization the methodology used in the case of a food-processing hub in Australia. The economic impact of this hub was measured by the direct capital expenditure on its creation, expenditure on units operation and flow-on effects of this expenditure on the regional and domestic economy. The authors use the multipliers calculated by standard input-output tables. For a certain increment to final demand, the direct and indirect pattern of production needed to support that increment could be determined. Moreover, consumption-induced multipliers must be determined, which requires creating a link between private consumption and income from wages and profits. These effects are obtained from a multi-industry general equilibrium model.

Some authors propose indicators and do analysis based on characteristics of SS policy, which should give the ultimate goal of economic development. Haukioja, Kaivo-oja, Karppinen, and Vähäsantanen (2018) indicate industries with comparative advantage in the country and internationally based on specialization and they measure regional resilience by an indicator based on diversity. Muštra, Šimundi, and Kuliš (2017) found a positive impact of smart specialization on regional resilience that is the ability to adjust a development path to shocks. However, they measured smart specialization as the number of patent applications from regions to the European Patent Office, but without restricting them to the areas of smart specializations indicated in S3.

Bzhalava (2018) finds that entrepreneurial opportunities and activities determine regional development and analyze start-ups' profiles in Baltic and Nordic countries using text mining methods that could be used to identify smart specialization priority areas. Similarly, Klimczak et al. (2017) used Web site queries to identify firms connected with SS areas in the Podkarpackie voivodeship in Poland.

Polido, Pires and Rodrigues (2019) analyze the link between S3 and sustainable development in economic, environmental, and social terms. They find further integration of regional innovation strategies with sustainable development is needed. On the example of the Centro region in Portugal, they show that the social dimension is neglected in S3 projects.

In the study edited by Stawicki and Wojnicka-Sycz (2014), an econometric model was estimated to examine the impact of smart specializations of the Mazowieckie Voivodeship on local development. The dependent variable reflecting the dynamics of development at the poviát level was the dynamics

of revenues of municipalities from Personal Income Tax (PIT) per capita in relation to the national average, which is a derivative of people's incomes. It was used due to the lack of data on GDP per capita at the poviats level. The explaining variables reflected the potential of industries related to smart specializations of Mazovia as well as embracing control variables. The estimated model showed the positive relationship between the dynamics of PIT revenues per capita in relation to the national average in the period 2012/2007 and the share of the number of employees in industries related to smart specializations of Mazovia in the total employed people in the poviats in 2008. This means that the designated smart specializations of Mazovia reflect the pro-development industries of the region.

Klimczak et al. (2017) checked, based on econometric analyses, whether the presence of smart specializations in poviats in the Podkarpackie voivodship has a positive impact on their socio-economic situation. It was found that the presence of entities associated with smart specializations, in particular those of industrial smart specializations (aviation and automotive) and ICT enterprises, means a higher income of the population in the poviats, and also affects a larger number of job offers, and at the same time a lower unemployment rate on the local labor market.

The concept of smart specializations underlines the importance of activities absorbing and spreading innovations arising in R&D centers. The success of smart specializations depends on the size of the sector – critical mass, strengthened by links between entities. Diffusion of knowledge takes place through the creation of networks in regions, including interregional links, which also contribute to the development of human capital associated with smart specializations (Stawicki & Wojnicka-Sycz, 2014). It means that those correctly indicated as smart specializations industries can be characterized by critical mass, due to previous good development and innovative activity based on cooperation with science and international competitiveness. In the case of emerging smart specializations, they should have such potential. Further, supported development can constitute an engine of development for other regional industries due to inter-industrial flows. It means that the development of SS industries can have effects on regional economic growth and development.

3. Data and methods

To check the relationship between the presence of Regional Smart Specializations (RIS) in voivodships and the economic development measured by per capita GDP, it was necessary to create variables reflecting the RIS of individual voivodships. For this purpose, information from the Smart Specialization

Platform was used, based on data from the final Regional Innovation Strategies, collected by Kamrowska-Zaluska (2019), on the connection of individual smart specializations from voivodships with relevant NACE divisions. The Smart Specialization Platform database connects priority areas with NACE divisions based on documents uploaded by regional authorities³.

Then the data of the Central Statistical Office was used, derived from the structural statistics of enterprises containing data on local units, collected according to the location of business, not the head office. This data relates to both the number of entities and the number of employees in local units in industries according to NACE divisions in voivodships. However, this data includes only enterprises, so it skips other types of entities, like health care units, and therefore is not available for all NACE divisions. In the econometric analysis, data on employed in local units of enterprises of NACE divisions connected with smart specialization areas in particular regions was used.

Table 1.1 presents the overview of data on employed in local units in NACE divisions connected with SS areas in Polish voivodships. The location quotient used for characterizing this data means the relation of the proportion of employed in adequate SS areas against all employed in a region to the proportion of employed in these industries against all employed in Poland.

In terms of the concentration of the number of employed in local units, the specialization of voivodships in the field of SS industries is visible because of the average location quotient – LQ for regions in this regard in 2017 was 1.11. Already the first quartile of voivodships had a level of concentration of people working in SS industries compared to the national average that was 5% higher and the third quartile was 16% higher. This shows that most regions were actually guided by the critical mass criterion – concentration/specialization in specific industries. The only voivodship where LQ, according to those working in local SS units was lower than 1, so the degree of concentration of employees in SS industries was lower than their average share in employment in Poland, was the Śląskie Voivodship (LQ = 0.84). A regional cluster in terms of employed in SS local units can be seen in the case of the Warmian-Masurian Voivodship, where the share of employed in given SS industries was 45% higher than the national average. Quite a high level of concentration of employees in SS industries also applied to the Opolskie and Lubuskie voivodships (LQ 1.23 and 1.22, respectively).

The average share of regions in the employed in given SS industries in Poland amounted to 7%, with a median of 5%. The highest share of 22% was noticed in the Mazowieckie voivodship, and the lowest – 2% in Opolskie. The

³ Retrieved 1 March, 2020, from https://s3platform.jrc.ec.europa.eu/map?p_p_id=captargmap_WAR_CapTargMapporlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_count=1

share of employed in given SS industries in Poland is, therefore, a derivative of the general potential of voivodships.

Table 1.1. Descriptive statistics for variables characterizing SS in 16 voivodeships in Poland

Variable	Average	Stand. deviation	Min	Q1	Me	Q3	Max
Share of the employed in SS in a region in the employed in adequate SS industries in Poland	0.07	0.05	0.02	0.03	0.05	0.09	0.22
LQ of employed in SS in 2017 (in a region in relation to Poland)	1.11	0.12	0.84	1.05	1.07	1.16	1.45
Share of employed in SS in all employed in a region	33.6	9.57	22.7	25.95	31.27	36.05	61.7
Dynamics of the share of SS industries in all employed in the region 2017/2012	102.9	4.4	96.9	98.6	102.3	107.2	110.3
Dynamics of the share of employed in SS industries in a region in adequate industries in Poland	100.9	5.9	91.1	97.5	100.4	105.4	114.3
Dynamics of LQ of employed in SS industries (in relation to Poland) 2017/2012	102.1	4.2	92.4	99.5	101.0	104.6	110.3

Source: Own elaboration based on Central Statistical Data from structural statistics of enterprises based – employment in local units.

The analysis of the LQ indicator shows that the regions indicated mainly industries in which they have a certain advantage, illustrated by the concentration of this activity in the region against the background of the country. The share of employed in SS industries in the total number of employed in regions reflects focusing on specific priorities while choosing SS areas. On average, this share was around 30%, with a minimum of around 23%. The third quartile, on the other hand, was around 36%. This means that most regions have indicated about 1/3rd of their economic potential as smart specializations. However, the maximum is about 60% and such a large share of industries at the level of NACE divisions applies to the Lodzkie Voivodship. Mazowieckie and Opolskie voivodeships indicated about 40% of their economy as SS.

The share of SS industries in those working in local units in regions increased on average in the period 2012–2017 and only slightly decreased in the Lubuskie, Lubelskie, Łódzkie, Podlasie, and Śląskie Voivodships.

On average, in all voivodships, the degree of concentration of employees in industries related to their regional smart specializations increased over the years 2012–2017. On average, in voivodships, the share of SS industries in total employment in adequate (different for individual regions) industries in Poland also increased. This means that in many cases the specialization of regions in their SS areas deepened. Only in nine voivodships did their share in the employed in the relevant SS industries in Poland decrease. However, LQ in terms of the number of employees in SS industries in regions relative to the country increased in all but four voivodeships. In most voivodships, there has been a deepening of specialization in the field of SS industries.

Econometric modeling was made using panel models and spatial panel models. Panel regressions for voivodships in the country enable operation on a larger set of time-spatial data than cross-sectional data for 16 voivodships. They also allow the control of the individual specifics of territorial units.

The general form of the panel model is as follows (Ciołek, 2017):

$$y_{it} = \beta_0 + \mathbf{X}_{it}\beta + \alpha_i + v_t + \varepsilon_{it} \quad i=1, \dots, N, t=1, \dots, T \quad (1)$$

where:

x_{it} – observation matrix on explanatory variables,

β - vector of structural parameters of the model,

α_i – individual effects, part of the variation of the y variable characteristic of the i -th unit; (N- effects),

v_t - periodic effects, part of the variability of the variable y characteristic of the period t (T-effects),

u_{it} – purely random error term.

The panel model can be estimated as:

- generalized regression (pooled regression) OLS (classical least squares method) – such estimation is permissible if the sample is homogeneous and there are no significant individual and periodic effects;
- fixed effects model (FE) – individual and/or periodic effects are constant over time or for a given unit and do not depend on random factors. Such a model can be estimated either by eliminating individual effects, replacing the values of variable levels with their deviations from the means for each voivodship (transformation within), or using OLS with zero-one variables (LSDV – Least Squares with dummy variables), determining the individual value of the constant for each voivodship (Ciołek, 2017);

- model with random effects (RE – random effects), in this model it is assumed that individual effects are part of the error term (Kufel, 2015).

Spatial models are an extension of classic econometric models, which include spatial effects, like spatial dependence and spatial heterogeneity. The spatial relationship in the set of observations is related to the fact that a certain observation in a given location may depend on another observation at a different location. The linear spatial lag model (SLM or SAR) can be described as:

$$y_i = \rho W y_i + X_i \beta + \varepsilon_i, \quad \varepsilon_i \sim N(0, \sigma^2 I) \quad (2)$$

where:

y is an $n \times 1$ vector of dependant variable,

X is an $n \times k$ matrix of explanatory variables,

W is an $n \times n$ spatial weights matrix,

ε is an $n \times 1$ vector of error terms,

ρ (rho) is estimated spatial autoregression parameter,

β is the $k \times 1$ vector of the estimated other model parameters.

Spatial error model (SEM) is a regression of the following form:

$$y_i = X_i \beta + u_i \quad u_i = \lambda W u_i + \varepsilon_i \quad \varepsilon_i \sim N(0, \sigma^2 I) \quad (3)$$

and (λ) is a spatial autocorrelation coefficient of the error term, while errors are purely random factors (Varga, 2009). To determine the effect of spatially lagged explanatory variables on the explained variable, however, the spatially lagged X (SLX) models of the following form are estimated:

$$y_{it} = X_{it} \beta + W X_{it} \theta + \varepsilon_{it} \quad \varepsilon_{it} \sim N(0, \sigma^2 I) \quad (4)$$

where y variable is the explained variable, and variables of the X matrix are explanatory variables. Parameters β represent the impact of explanatory variables in a given region while parameters θ show the weighted impact of explanatory variables from neighboring regions. The Spatial Durbin Model (SDM) is a combination of the spatial lag model and the spatially lagged X model.

In the panel version, the spatial lag model has the form:

$$y_{it} = \rho W y_{it} + X_{it} \beta + \alpha_i + \varepsilon_{it} \quad t=1, \dots, T, i=1, \dots, N \quad (5)$$

and it is assumed that $\alpha_i \sim N(0, \sigma_\alpha^2)$ in the case of random effects model and α_i is a vector of parameters estimated in the fixed effects version of the model.

Panel spatial error model is focused on spatial autocorrelation in error term:

$$y_{it} = X_{it} \beta + \alpha_i + u_{it}, \quad u_{it} = \lambda W u_{it} + \varepsilon_{it} \quad (6)$$

Panel spatial Durbin model is a generalized version of the spatial lag model (or spatial autoregression model - SAR) with taking into account spatially lagged explanatory variables (see Belotti, Hughes, & Mortari, 2017; Suchecki ed., 2012):

$$y_{it} = \rho W y_{it} + X_{it} \beta + W X_{it} \theta + \alpha_i + \varepsilon_{it}. \quad (7)$$

4. Results

Based on constructed variables reflecting smart specializations and GDP data, panel models and spatial models were estimated. The following relationship was analyzed:

$$\ln \text{PKB}_{pc} = f(\text{SS}, x_i) \quad (8)$$

where: $\ln \text{PKB}_{pc}$ – natural logarithm of Gross Domestic Product in constant prices per capita in PLN, SS – variables reflecting smart specializations, x_i – control variables.

Panel models were estimated by first diagnosing the estimated pooled regression model using tests of the overall significance of the group mean inequalities allowing the assessment of the validity of using the pooled regression model against a panel model with fixed effects. Moreover, the Breusch Pagan test was used to compare the pooled regression model against a random effect model, and the Hausman test was used, allowing a choice between a panel model with random and fixed effects. Then, the correct version of the panel model was estimated and was verified using the test for normality of residuals distribution, the test for heteroscedasticity and the test for autocorrelation of residuals of the 1-st order. In the event of heteroscedasticity and autocorrelation of residuals, the model was estimated using robust standard errors. Subsequently, estimated relationships were

examined for the legitimacy of the use of appropriate spatial panel models. For this purpose, a Queen-type direct neighborhood matrix was created.

The validity of using the spatial Durbin model (SDM), SAR model, and SEM model was investigated. Each time spatial models were tested in terms of the validity of using models with fixed and random effects and were compared using the Hausman test. Models were estimated using standard errors resistant to heteroscedasticity, and in the case of models with fixed effects also on residual autocorrelation (Driscoll-Kraay standard errors; see Belotti, Hughes, & Mortari, 2017; Hoechle, 2007; Drukker, Peng, Prucha, & Raciborski, 2013). Individual spatial models were compared using the Akaike criterion (AIC) and those with its minimum value were taken into account. Moreover, the models were compared according to the value of the determination coefficient R^2 and those with its maximum value were taken into account.

A panel model with random effects was estimated, making the natural logarithm of Gross Domestic Product per capita at constant prices in voivodships in 2012–2017 dependent on the number of employed in local units of regional smart specializations in a given year and the unemployment rate in the previous year, which showed the autocorrelation of 1st degree of residuals. For this reason, a panel model with random effects with standard errors, including this type of disturbance, was estimated. This model showed that increasing the number of employed in RSS local units in 2012-2017 contributed to an increase in GDP per capita in voivodships (an increase in the number of employed in RSS by 1000 people meant a change in GDP per capita at constant prices by 0.087%), while the unemployment rate in the previous period reduced GDP per capita in the regions.

The SDM model with fixed effects and the SAR model with fixed effects were estimated because, in these models, the Hausman test indicated the validity of using FE models. The SDM model had a higher R^2 (overall $R^2 = 0.57$) than the SAR model (0.43). The SDM model confirmed the observed relationships, that is, the impact of the growing number of employees of local RSS industries in regions on GDP per capita, but also pointed to the positive impact of higher GDP per capita in neighboring regions on GDP in a given region. The number of people employed in the RSS industries in neighboring voivodships was, however, insignificant for GDP per capita in a given region. The SDM model preference for SAR and SEM was indicated by tests proposed by Belotti, Hughes, and Mortari (2017).

Table 1.2. Models with the explained variable Gross Domestic Product per capita

Ln GDP per capita in constant prices 2012–2017				
Model type	RE	RE	FE SDM	RE SEM
Estimation type	GLS robust	GLS with disturbances AR(1)	quasi MLE robust for autocorrelation (to 4th lag) and heteroscedasticity	quasi MLE robust for heteroscedasticity
Const	10.78 [0.025]***	10.76[0.04]***		10.56 [0.06]***
Ess	8.3e-07 [5.1e-08]***	8.7e-07 [1.2e-07]***	2.7e-07 [9.6e-08] **	2.2e-07[1.1e-07]**
Unempl in previous year	-0.025 [0.001]***	-0.024 [0.001]***	-0.002 [0.001]*	-0.02 [0.003]***
Ess in neighboring regions			-2.1e-07[1.4e-07]	
Rho			0.9[0.02]***	
Lambda				0.97 [0.01]***
R ² overall	0.84	0.84	0.57	0.6
AIC	bd	bd	-536	-386
Hausman test Chi ²	1.82 (p=0.4)		17.92 (p=0,0013)	4.34 (p=0.23)

Note: Standard errors are given in square brackets, *** - statistically significant at 0.001, ** - statistically significant at 0.05, * statistically significant at 0.1.

Source: Own calculations in the STATA 16 package; Ess – employed in local units in smart specialization industries, Unempl - unemployment rate.

In addition, the SEM model with random effects was estimated (according to the Hausman test), which showed the same relationships in terms of those employed in the RSS industries and the unemployment rate in the previous period and GDP per capita, but also proved a positive impact on GDP per capita in a given region of other variables from neighboring voivodships not included in the model. At the same time, this model had the highest R² coefficient compared to the SAR and SDM model, which is 0.6 (Table 1.2).

Therefore, it should be acknowledged that RSS industries in voivodships have been indicated correctly and, on average, in the country, have a positive impact on the GDP per capita, and thus probably generate spill-over effects on other sectors of the regions' economies.

5. Discussion and conclusions

Regional smart specializations in the EU have been indicated to stimulate the innovative development of regions. They reflect areas not necessarily of the highest technological advancement, but those in which a given region specializes and has a comparative advantage, and implements innovations based on conducted research. Strategies for smart specializations assume the joint implementation of projects by enterprises and scientific units, and thus the occurrence of cooperation of these sectors in the regions to develop innovative solutions. This means that smart specializations should create innovative ecosystems based on links between enterprises and between sectors in the research and innovation process. However, according to the theory of systems, systems constitute too complicated a phenomena to be described in detail in terms of individual components and relationships between them, and the most important thing is to achieve the assumed effect from their operation (see Skyttner, 2006). For smart specialization ecosystems, it will mean the impact on local and regional development through stronger innovation and internationalization of SS industries.

The presented analysis using spatial panel models showed that in Poland, increased employment in SS areas related industries has an impact on higher real GDP per capita in the regions, which is economic development. Moreover, voivodeships' specialization in SS areas measured by employment in them increases. Hence, the positive effect of the ecosystems of SS in regions is visible. In the article by Wojnicka-Sycz, Kaczyński, and Sycz (2020), it has been shown that in the case of the Podkarpackie voivodeship, most of the smart specializations create innovative ecosystems and have a positive impact on local development.

According to the theory of growth poles, innovative industries with a certain critical mass create supply and demand ties with other industries, and hence should also stimulate the development of other industries through their development. They then form the main economic base of regions with a pro-innovative and pro-export orientation. As claimed by Hirschman and Friedman, as well as Krugman and the new economic geography, and as also demonstrated by the model of the territorial growth pole for Poland, this concentration in economic space is often also a concentration in a geographical space, which allows taking advantage of the benefits of agglomeration. Currently, there may be a geographical concentration of a given industry in a given area only to a certain extent in its value chain, due to their modularization on a global scale (see Gancarczyk, Gancarczyk, & Bohatkiewicz, 2017), which seems to reflect, for example, the situation of the aviation industry, which is a smart specialization in the Podkarpackie Voivodeship. This industry in the

voivodship is dominated by international enterprises, which carry out only small fragments of innovative activity here or rather focus on production (Klimczak, 2006). Despite this, there is a critical mass in the voivodship in terms of the number of employees in this industry and related industries (metal and metal products industries, plastics industry), as well as in the field of R&D activities related to aviation (Klimczak et al., 2017). The relationship in the form of stimulating growth, however, occurs not only between industries but also between territories due to the positive impact of stronger development of given areas induced by, among others, the development of, for example, RSS industries, to other geographical areas. Such correlation was found in the Podkarpackie province in relation to the labor market (unemployment rate). On the Polish scale, there was no impact of the given RSS industries on the development of the surrounding voivodships, but the stimulation of growth of a given region by RSS was found, and in turn, a stronger development of some regions, including caused by RSS, gave spill-over effects to other provinces, as shown by spatial models.

The desired directions for the expansion of the analysis proposed in the article are to check the impact of SS not only on GDP, which is the final assumed effect of SS policy but also on R&D and innovation activities, as well as to compare the effects observed in Poland with other countries and to examine the effects in terms of R&D&I and GDP from SS on an EU-wide scale. It should be noted that the analysis at the level of NACE divisions, and such data are available for voivodships from the statistical office, is broader than the actual scope of smart specializations. Therefore, an in-depth analysis of individual regions is also needed to evaluate the impact of SS on the above variables.

As the analyses carried out for Poland show, the occurrence of smart specializations has been found to translate into stronger regional development. This means that the actually indicated areas are usually the basic drivers of regional development, mainly due to their innovation. Support for their development, especially R&D and innovation activities, should stimulate the process of entrepreneurial discovery and the generation of inventions, as well as encouragement, through supply and demand relationships, of the development of other sectors of the regions, and thus economic growth.

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Biographical note

Elżbieta Wojnicka-Sycz (Ph.D., Hab.) – Associate Professor at the University of Gdańsk at the Faculty of Management and at the Gdańsk University of Technology at the Faculty of Architecture. Her specialization is in the field of regional development, analyses on innovation and technology transfer, spatial management from the point of view of innovation, the impact of structural funds on economic development, development of cities, and metropolitan areas. She is the author and co-author of over 200 scientific and popular science publications: books, articles, reports, many of which are international in scope. Coordinator and / or expert in about 85 research and development and application projects financed / co-financed by the OECD, European Commission, VI and VII EU Framework Program, EU structural funds in Poland, NCN, NCBiR, Ministry of Development / Regional Development, Polish Agency for Enterprise Development, Ministry of Agriculture, Ministry of Economy, Industrial Development Agency, marshal offices of many provinces and others.

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Factors and barriers to the development of smart urban mobility - the perspective of Polish medium-sized cities

Magdalena Kachniewska¹

Abstract

The main purpose of this paper is to indicate factors and barriers to the development of smart mobility in Polish medium-sized cities. A combination of three methods was used (mind mapping, STEEP analysis, and panel discussion). They were carried out during expert workshops with the participation of representatives and presidents of 14 cities, during the 4th Industrial Forum in Karpacz, December 2019. The paper first presents the general concept of the smart city and smart mobility development. Then, the most important factors and barriers to the development of smart mobility in Poland were formulated on the basis of the research. The article has important value from the point of view of urban study researchers and city governance practitioners. The results from the study would be of interest to those in similar settings, as it contributes with valuable insights on how the chances of implementing smart mobility assumptions are perceived in the opinion of medium-sized cities' representatives. The paper contributes to the knowledge of city governance and new business model managers (data-based services). It helps to recognize and consider uncertainties they are likely to face.

Keywords: smart mobility; smart cities; open-data, data-based governance, IoT, big data

1. Introduction

Cities are characterized more and more by “mega-trends” which are going to crash their balances (Kanter & Stanley, 2009). While cities play an important role in social and economic development, they also have a huge impact on

¹ Magdalena Kachniewska, Ph.D., Hab., Prof. SGH, Department of International Management, Institute of International Management and Marketing, Warsaw School of Economics, Al. Niepodległości 162, Warsaw, Poland, e-mail: Magdalena.Kachniewska@sgh.waw.pl (ORCID.ID: 0000-0003-3163-086).

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the environment (Mori & Christodoulou, 2012). In 2019, 55% of the global population lived in urban areas; however, by 2050, over 66% of global population will live in cities. Demographic change and climate crisis require a quick and radical reaction. This pressure is even more pronounced in Europe, with more than two-thirds of the population already living in cities. Even in Poland, with only four cities with half a million citizens and one city with over 1 million citizens, city dwellers make up over 60% of the total population. In the context of mobility, one piece of information seems important: the lower the urban density, the more energy is consumed for electricity and transportation, as proved by the fact that CO₂ emissions per capita drop with the increase of urban areas density.

Both research and examples concerning the implementation of the smart city idea concern mainly large cities and metropolitan areas. Medium-sized cities, which are numerous in Poland, remain outside the spectrum of interest in scientific research. Although the cities have to deal with the effects of advancing globalization trends, their residents feel the overwhelming need for consumption that has been inaccessible to them for a long time. Awareness of the climate crisis, difficult access to unpolluted air, deteriorating quality of life and threat to health do not penetrate as deeply into the consciousness of residents as to mobilize them to self-limitations in the sphere of consumption. Taking into account just the automotive aspect, according to the Busradar Report (2018), in Poland, there is still a belief that one of the measures of the level of household welfare is having a car (46% of respondents think so). 86.6% of households have at least one car, 25% have two cars. In Poland, there are 571 passenger cars per one thousand inhabitants. This is less than in Italy (625 cars per thousand inhabitants), but more than in Germany (555), Spain (492), or France (479). The heavy traffic does also include public and freight transport, causing congestion, air pollution, and noise. The congestion of cities also means problems with the availability of parking spaces, the growing number of road accidents, increasing medical costs, and other economic effects (Welle et al., 2018). Other problems of medium-sized Polish cities include urban sprawl, urban depopulation, increasing road congestion and environmental pollution, economic instability in the global economy, and the phenomenon of an aging society.

Along with the dynamic expansion of urban areas, effective urban development becomes a priority for both large metropolises and cities remaining outside the world leaders. Sustainable and modern ecological cities are perceived as a key condition to avert the climate crisis, improve the quality of life, and (in the case of smaller urban units) stop the outflow of residents. The strategic role of cities in the social, economic and environmental development of modern economies implies the need for scientific discussion

on the vision and directions of their development. This is not only in relation to the implementation of the new generation of information and communication technologies (ICT) supporting the service of residents but also in the context of generating and implementing ecological innovations (reduction of carbon dioxide emissions, energy efficiency) and modern social solutions. In particular, contemporary mobility planning, due to the need for strong stakeholder involvement, extensive public consultation and preparation of a comprehensive plan, is an extremely complex and time-consuming process.

Ten years ago, the European Commission (EC, 2009) pointed out the need for integrated transport planning in accordance with the principles of sustainable development. The December 2013 Communication (EC, 2013) presented a detailed package of actions on mobility, largely devoted to urban mobility planning. Thus, attention was drawn to the importance of a strategic approach, as well as the integration of transport planning (including accessibility and mobility) with the areas of spatial planning, environmental protection, or health. The instrument that allows the implementation of such a policy in accordance with the recommendations of the European Commission is the Sustainable Urban Mobility Plan (SUMP), the development of which in individual cities is optional for now. The largest Polish cities are already undertaking activities to develop their own documents (e.g., Wrocław, Warsaw, Gdynia, Gdansk, and Krakow). For now, none of the smaller cities has shown interest in this venture.

Unlike traditional transport planning, this process should focus not only on providing better traffic conditions but primarily on striving to ensure the highest quality of life for residents, prioritizing aspects such as accessibility, social equality, health, and environmental protection. Therefore, the ability to identify and meet the needs of various city development stakeholders seems to be a significant challenge.

2. Literature background

2.1. A comprehensive framework for a smart city and a city's stakeholders concept

The smart city concept has received increasing attention during the last two decades along with the rapid technological advancement. In the area of the EU alone, over 1300 smart city related proposals, commitments, and projects exist. Cities worldwide have started to look for solutions that enable transportation linkages, mixed land uses, and high-quality urban services with long-term positive effects on the economy. For instance, a high-quality and

more efficient public transport that responds to economic needs and connects labor with employment is considered a key element for city growth. Many of the new approaches related to urban services have been based on harnessing technologies, helping to create “smart cities” (Albino et al., 2015).

The goal of the smart city concept is a modern urban data-based management, considering the applicable ecological standards while saving resources and achieving the expected results. Predominantly this term is understood as a certain intellectual ability that addresses several innovative socio-technical and socio-economic aspects of growth (Zygiaris, 2013). Researchers, multinational companies as well as governments are strongly pushing towards smarter approaches for cities, but it is still missing a common understanding and an embedded well-acknowledged definition of such an initiative (Caragliu et al., 2011). Despite the confusion about what a smart city is (Anthopoulos, 2015; Vanolo, 2014; Yanrong et al., 2014; Gil-Garcia et al., 2015; Granath, 2016; Hollands, 2008; O’Grady & O’Hare, 2012), several similar terms are often used interchangeably. The discussion revolves around issues such as “digital city” (Besselaar et al., 2005; Tan, 1999; Yovanof & Hazapis, 2009), “intelligent city” (Komninos, 2008; Harrison et al., 2010), “knowledge city” (Dirks, 2009; Carrillo, 2004), “information city” (Sproull & Patterson, 2004; Stolfi & Sussman, 2001), “ubiquitous city” (Lee et al., 2008; Shin, 2009), “smart communities” (Kanter et al., 2009), and much more.

BSI PAS 180 (2014) provides the following working definition: smart city is a term denoting the effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens. The ITU-T Focus Group on Smart Sustainable Cities analyzed nearly 100 definitions and used these to develop the following one: “a smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects”.

Some definitions of an intelligent city emphasize primarily technological issues, while others do concentrate on social ones. Harrison et al. (2010), in an IBM corporate document, stated that the term “smart city” denotes an “instrumented, interconnected, and intelligent city.” “Instrumented” refers to the capability of capturing and integrating live real world data through the use of sensors, meters, appliances, personal devices, and other similar sensors. “Interconnected” means the integration of these data into a computing platform that allows the communication of such information among the various city services. “Intelligent” refers to the inclusion of complex analytics, modeling, optimization, and visualization services to make better operational decisions

(Harrison et al., 2010). Nam and Pardo (2014) claim that a city can hardly become smart because of technology alone, while for corporations (Cisco Systems, Siemens AG) the technological component is the key component to their conceptions of smart cities. Peng, Nunes, and Zheng (2017) defined a “smart city” as a city using a set of advanced technologies, such as wireless sensors, smart meters, intelligent vehicles, smartphones, mobile networks or data storage technologies”. Similarly, Guo et al. (2017) stressed the urban development based on the integration of many information and communication technology (ICT) solutions to manage the city’s resources.

The abovementioned approach has been critiqued by Greenfield (2013) who argues that corporate-designed cities such as Songdo (Korea), Masdar City (UAE), or PlanIT Valley (Portugal) lose sight of the individual functions of the city, disregard the value of complexity, unplanned scenarios, and the mixed uses of urban spaces. Caragliu et al. (2011) state that a city is really smart “... when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” (p. 70). The majority of researchers (Cugurullo, 2013; Kitchin, 2014; Vanolo, 2014) emphasize that technology could be used in cities to empower citizens by adapting those technologies to their needs rather than adapting their lives to technological exigencies.

According to Albino et al. (2015), one of the reasons for the lack of a universal definition of a smart city is the fact that the abovementioned concepts fall into two different dimensions. The first of them refers to the so-called hard components (i.e., intelligent infrastructure, mobility and logistics, energy networks, water and sewage management, waste management) where ICT technologies are of key importance. The second context emphasizes soft components (relations, education, culture, social inclusion), where the use of ICT is not usually a priority.

A review of the literature indicates that the concept of a smart city quite often combines the digital dimension with the social dimension. As a common perception, the concept of a smart city coincides with a digital city and refers to the development of a broadly understood ICT infrastructure, which is flexible and service-oriented as its purpose is to meet the needs of all stakeholders: local authorities, entrepreneurs and residents (Yovanof & Hazapis, 2009). In this approach, the city’s intelligence means its ability to support the development of all its inhabitants. Therefore, it should be pointed out that not every digital city is intelligent, while every intelligent city contains a digital component (Albino et al., 2015). In a similar spirit, Hollands (2008) notes that the concept of a smart city refers to building an ICT-based infrastructure to support social and urban development, by implementing economic solutions,

engaging residents, and improving management efficiency. Manville et al. (2014) define a smart city as a city where public issues are solved using ICT, with the involvement of various types of stakeholders working in partnership with the city authorities. Yet, more collaborative research is needed in order to help practitioners understand when technology is the solution, and when it is not (Glasmeier & Christopherson, 2015).

Numerous studies have been undertaken on smart city assessment frameworks (e.g., Carli et al., 2013; Neirotti et al., 2014). They invariably work their frameworks from the findings of the Technical University of Vienna research group, who indicated six original dimensions including economy, people, governance, mobility, environment, and living (the last issue raises some doubts, because living conditions are the result of previous elements and therefore it is difficult to treat them as a separate category). Albino et al. (2015) pointed out the following features of smart cities: (a) network infrastructure that enhances the effectiveness of political and social activities as well as cultural development; (b) business and creative activities undertaken to promote urban development; (c) social inclusion of urban residents and the involvement of social capital in urban development, and (d) the natural environment as a strategic component of the future.

Ortiz-Fournier et al. (2010) described a smart city in the context of its intelligent inhabitants, the quality of social interactions, and integration with public life. In the current perception of the smart city concept, the attention is focused on the needs and preferences of the inhabitants – technical solutions should just serve their interests. Having that in mind, the city’s special “intellectual ability” should cover the social and technological aspects of green economic growth, which is used to formulate the definition of a smart city as a green city in relation to its ability to solve environmental problems (Zygiaris, 2013; Beretta, 2018).

As the concept of an intelligent city takes into account the human component, it emphasizes the key role of education, science, culture and knowledge in the development of modern urban initiatives. For this reason, “knowledge city” invests in knowledge-based solutions, and contributes to creating value in both the private and public sectors (Carrillo, 2004). The development of this concept was inspired by the emergence of cloud computing technology and their application in urban service provision systems. Open access to data contributes to the creation of new urban architecture that encourages the collection, processing and sharing of knowledge through widely available mobile devices. Trying to combine the abovementioned aspects, Komninos (2011) points out four key dimensions relating to (a) the use of ICT to build a digital city; (b) the use of ICT to improve living and working conditions; (c) the use of ICT in an advanced urban infrastructure;

and (d) the integration of ICT with human capital to stimulate innovation and the accumulation and sharing of knowledge.

Obviously, the future Internet domain landscape comprises a great diversity of technology related topics involved in the implementation of smart cities, e.g. ubiquitous computing, networking, open data, big data, geographic information system (GIS), cloud computing, service-oriented architecture (SOA), e-government, embedded networks and internet of things (IoT). These technologies overcome the fragmented market and island solutions of smart cities applications and provide generic solutions to all cities, but still the main target for developing smart cities is to pursue convenience of public services; delicacy of city management; livability of the living environment; smartness of infrastructures and long-term effectiveness of network security. Therefore, the term smart city also refers to ways of managing public space and effectively solving social and environmental problems in the city (Van der Meer & Van Winden, 2003). This is in addition to using information and communication technologies to increase the interactivity and efficiency of the urban infrastructure and its components, as well as to raise the awareness of its inhabitants (Azkuna, 2012).

A city is a complex system composed of a fusion of individuals with carried competencies, personal values. Smith and Ingram (2002) address the importance of stakeholders' participation in the context of new governance, and Bifulco et al. (2014) claim that the coming of a smart city requires a transformation in the interpretation of stakeholders' roles and participation. Transformation from a non-smart city to a smart city entails the interaction of political and institutional components with technology as the smart city innovation (Mauher & Smokvina, 2008). According to Puro et al. (2013), one of the constituents distinguishing smart city management is citizen participation.

A stakeholder is any group or individual who can affect or be affected by the achievement of an organization's purpose (Freeman et al., 1984). Every city is also a system of stakeholders (Belissent, 2010) and incorporating them into the smart city management means balancing interests and muffling all obstacles (Roy, 2005). Co-creation in service design is usually referred to as value co-creation (Vargo & Lusch 2008) which is an integral subject of service-dominant logic paradigm. Value proposition is associated with the stakeholder relations and business model design. Value is linked to benefits (Rescher, 1969) each stakeholder is seeking from the value networks and stakeholder relations. The value may occur in the form of financial profits, cost savings, goods, services, knowledge or in improved quality (Sainio et al., 2011; Allee, 2008), but received value may further emerge in-directly in the value networks (Allee, 2008; Ojala & Tyrväinen, 2011). Government, academic institutions, and the private sector can only offer value propositions

to the citizens and actual value is created collaboratively, making citizens co-creators of value (Lusch & Vargo, 2006), while acknowledging that citizens – as consumers – participate in the development of the core offering itself and view it as a component of value cocreation. Maglio and Spohrer (2008) argue that a service system is defined as a configuration of people, technologies, organizations, and shared information that are able to create and deliver value to the interested entities through service. According to Polese (2009), interaction becomes the driver of value, which develops a joint process of value creation in the service system, and city performance is not only supported by and measured by the hard infrastructure, but also the availability of social and communication improvements. The smart city strategy acknowledges the common goals and value creation possibilities to citizens and stakeholders in public and private sectors by means of digital technologies. Therefore, an explicit smart city design clarifies complex smart city governance, stakeholder relationships, orchestration, and decision-making procedures (Scuotto et al., 2016; Vilajosana et al., 2013), and advances technological compatibility and correct resource allocation in cities (Carvalho, 2015; Scuotto et al., 2016; Vilajosana et al., 2013), but above all smart city initiatives should aim to improve the quality of citizens lives.

3. Main concepts of smart mobility and sustainable mobility

Intelligent/smart mobility is usually indicated as the most desirable option for sustainable transport systems (Pinna et al., 2017). The “smart mobility” concept and methodical origin can be found in the smart city paradigm (Albino et al., 2015; Neirotti, 2014). Benevolo et al. (2016) define smart mobility as “a set of coordinated actions to improve the efficiency, effectiveness and environmental sustainability of cities” (p. 70). The main aspect of intelligent mobility understood in this way is connectivity, which, based on big data, allows users to share, acquire and analyze all traffic information in real time, which is also a determinant of dynamic management at the local government level (Pinna et al., 2017). In this approach, intelligent mobility must cover the entire passenger-transport management system, tracking applications and logistics, parking management and car sharing services (Yue, Chye, & Hoy, 2017). More attention is also required for pedestrians, including people with reduced mobility (development of accessibility standards, provision of information, promotion of pedestrian traffic and the gradual creation of safe and attractive mobility conditions).

As a component of a smart city, transport or mobility relates to the “hard,” ‘techno-centric’ domain of smart city, both in theory and to a great extent in practice. This is reflected in much of the investment and innovation in the

‘mobility’ sector (Neirotti et al., 2014). The transport and mobility domain has the highest number of initiatives worldwide within the approach to smart city (Papa & Lauwers, 2015). A large share of the studies in the field of smart mobility is related to sustainable thinking (see for example, Mangiaracina et al., 2012; Lyons et al., 2012; Agha, 2016). According to Benevolo et al. (2016), research into the rapidly evolving initiatives within smart mobility falls largely under two sub-fields. The first is alternative fuels and propulsion vehicles (including electric, hybrid, hydrogen, fuel cells, and Compressed Natural Gas (CNG) vehicles). The second is the integration and assimilation of ICT into the traditional road transport and automobile sector, enabling it to produce new travel forms and practices. These are automated and autonomous features and vehicles, integrated and connected vehicles, users’ apps for car sharing, car-pooling, ridesharing, ticketing, parking, navigation, and information. Finally, there is also Intelligent Transport System (ITS) including transport infrastructure technologies for collecting data, analyzing it and creating dynamic smart traffic control systems that monitor and manage the demand for and supply of transport (Benevolo et al., 2016, pp. 17–24).

Pursuant to EU Directive 2010/40/EU, intelligent transport systems “integrate telecommunications, electronic, and IT technologies with transport engineering for the planning, design, operation, maintenance and management of transport systems” (p. 14). Modern technological and organizational solutions, on which intelligent transport systems (ITS) are based, enable, among others, traffic control and the creation of special zones with limited access and low CO₂ emissions by limiting the number of private cars in designated areas of cities. Their goal is also to increase the safety of traffic participants and to improve the efficiency of the transport system, and indirectly to protect the environment. ITS also enables better information, sending alerts (“push” system), safer, better coordinated use of transport networks, the ability to manage the handling of large events, traffic control and quick emergency response (crisis management). Most scientific research confirms that ITS supports smart urban mobility (Mangiaracina, 2017; Papa et al., 2017; Battarra, Zucaro & Tremiterra, 2017) by reducing traffic congestion, reducing air pollution, increasing energy efficiency, and promoting the development of related industries (Chandra, Harun, & Reshma, 2017).

New mobility services and business models are changing urban transport, affecting both the supply and demand sides of the urban mobility market. App-based mobility services such as car and ride sharing and Mobility as a Service (MaaS) through single or integrated ticketing services, offer new possibilities to expand and complement existing mobility and can help to balance public and private transport in cities. Evidence shows that these developments can lead to a significant reduction in single occupancy private car use and an increase

of public transport use, leading to a strong reduction in congestion, local air pollution, and CO₂ emissions (ITF, 2015; 2017). These benefits will occur when more vehicles are shared and private car ownership is reduced. Under these conditions, new mobility can change the way people live in cities. This illustrates the magnitude of the change and the important benefits resulting in moving towards an increasing use of shared mobility, public transport and integrated use of various mobility services.

The shift from conventional mobility to sustainable mobility involves moving from an idea of transport system performance, primarily evaluated based on speed, convenience, and affordability of motor vehicle travel to a more comprehensive, multimodal system of evaluation that considers a range of modes, objectives, impacts and improvement options (Litman, 2013). The sustainable mobility paradigm (Banister, 2008) strengthens links between land use and transport (sustainable in the senses of social, environmental, and climate aspects). It is clear that the capacity of the transport system could not continue expanding. Sustainable mobility is aimed at the ultimate goal of mobility, which is accessibility (Kennedy et al., 2005; Litman, 2013) and can be referred to as access-based.

An interesting approach to overcome the conventional mobility planning can be defined as the “place making” paradigm (Jones & Evans, 2012; Cervero, 2009; Gehl, 2013). The key drivers configuring the urban fabric and creating a place are referred to as the 5D paradigm (density, diversity, design, distance to transit, and destination accessibility). The attention has been directed to the people and the places of the city and the emphasis is on the creation of quality of urban places while in “conventional” mobility planning the smart mobility approach gains the most importance (the potential of optimizing existing city infrastructure, services, and urban behavior through the deployment and utilization of new technologies). A “place making” paradigm seems to be closer to the consumer-centered smart mobility approach, which is characterized by a strong emphasis on the human side. It combines a strong focus on putting the customer at the heart of the service offering with the requirement of integrating all transport opportunities into a whole system: the user and their experience and requirements must be at the center of mobility provision (Papa & Lauwers, 2015).

New mobility services range from shared mobility such as car, bike and ride-sharing services to multimodal, door-to-door trip planning, and mobility as a service. They complement city public transport services by providing mobility solutions for the first and last mile, reaching less dense or underserved areas and developing integrated ticketing or payment services, providing attractive and comprehensive mobility options also for those whose

needs haven not been fulfilled by traditional public transit services and thus channeling some new demand and custom for public transportation system.

4. Research approach and methods

As the aim of this study is to understand the complexity in a city's mobility planning processes and how this complexity affects the outcomes when realizing smart city ambitions, a combination of three qualitative and interpretative methods was used: a mind mapping technique, a STEEP analysis (see below) and a panel discussion. The discussion was carried out during expert workshops with the participation of representatives of seven medium-sized cities, attending the 4th Industrial Forum in Karpacz, in December 2019. Namely the representatives of Legnica, Jelenia Góra, Konin, Tarnowskie Góry, Grudziądz, Jaworzno and Sobotka (all the cities are situated in Poland and each of them has from 80,000 to 100,000 inhabitants). Altogether 57 people took part in the workshop discussion.

The purpose of the STEEP analysis was to identify the external environment factors that are opportunities and threats for intelligent mobility projects in medium-sized cities, and to determine the strength of this impact. The criteria covered by the STEEP analysis typically include (1) socio-cultural factors (values, lifestyle, demographic growth, religion, level, education, employee qualifications, population income, society's attitude towards a given industry), (2) technological factors (scientific discoveries, patents, technology level in a given industry, impact of new technologies, changes in the organization of production), (3) natural environment (environmental protection, pollution, climate change, renewable energy, recycling), (4) economic factors (GDP, inflation rate, unemployment rate, budget deficit, market size, interest rates, taxation, exchange rate currency, trade and payment balance, level of wages) and (5) political factors (regulations regarding economic activity, attitude of the authorities towards industry, socio-economic ideology of the government, stability of governments, stability of legal regulations, (re) privatization processes, EU membership).

All the participants of the STEEP analysis process took part in two working panels: the first one was aimed at the identification of factors constituting opportunities or threats to smart mobility in medium-sized cities, while the second one was devoted to the quantitative assessment of the importance of STEEP factors. The scale adopted for the purposes of the analysis (1-5) indicated:

- 5 - a very encouraging environment
- 4 - encouraging environment
- 3 - neutral environment

2 - non encouraging environment

1 - strongly discouraging environment

Interviewees were also asked to mention the three most negative impacts (outcomes) or unsustainable features of today's transportation system in their cities and then, rank them by order of importance from the most influential (1) to the least influential (5). In the last stage of the discussion they were asked to suggest (or report) the possible solutions to addressing the most pressing issues of urban mobility. The interviewees were asked to consider a social perspective to their responses instead of their personal preferences.

5. Research results

Discussion on the opportunities and threats of implementing smart mobility has shown quite different opinions on the importance of different factors. First, the workshop participants have indicated smart city decision factors, enumerating two groups. The first one includes citizen participation, leadership and infrastructure, as internal factors. The other one (external factors) covers: the idea of data-based management and a decentralized approach to innovation.

The main stakeholders of an intelligent mobility include: residents and guests (tourists), local government, budgetary units, municipal companies, educational units, universities and research centers, business entities. They all should be offered a promotional campaign to build a "front" of interest and support. During the workshop, all the stakeholders surrounding the smart city were divided into direct and indirect ones. The first group includes: residents and city government, government, and local enterprises. Urban authorities are the main actors in building smart cities and delivering services to citizens. In contrast, urban residents and enterprises should become the most direct beneficiaries of smart city services (citizens benefit from the improved quality of life, while local enterprises can benefit from creating new profits by leveraging smart city infrastructure). An indirect stakeholders group includes providers of smart technology, infrastructure services, and applications.

The most important postulates of the debate participants concerned the following issues:

- 1) resident participation in urban policy decisions – in this respect, there was an urgent need to develop tools that would enable residents express their wishes and seek solutions to them. These tools should take into account the significant impact that ICT has had on the behavior and communication of various entities, and thus, the specific expectations of residents regarding the availability of public services, the possibility of submitting comments and demands. It has been argued that the expansion of citizen participation in the form

- of bottom-up, experimental innovation; open-source platforms; and living labs appeared as a new urban plan.
- 2) the leadership of the local governor – the success or failure of a smart city policy largely depends on the pace of implementation and diffusion of technological solutions. The debate participants emphasized, however, that the idea of a smart city cannot be reduced to the computerization of the municipality, which is too often the case in Polish cities. A suggested solution to this problem may be the inclusion of an IT director in the team responsible for building an intelligent city in the area of infrastructure, digital solutions, long-term financing, appropriate allocation of expertise, employee education, staff accountability, and the standardization and interoperability of systems.
 - 3) data-based management – the basis of the smart city concept is the development search for new data sources and investment in the development of intelligent infrastructure that allows data generation, acquisition, exchange and analysis in real time (artificial intelligence, wireless communication, the IoT, GPS positioning, etc.).
 - 4) a decentralized approach to innovation – specialized knowledge cannot be sought solely within the government – it comes from various sectors of society.

The concept of smart cities in a simplified way consists in investments that are focused on sustainable economic growth of the city and improving the quality of life of the inhabitants. The most important thing is that they are to take place not only by the expansion of the broadly understood infrastructure (transport, ICT), but also one of the more important goals is to involve the citizens living in the city to participate more fully in the life of the agglomeration. At the same time, the participants of the debate emphasized the fact that transport is a special kind of activity, strongly based on intelligent solutions. The benefits of their use are felt by all city users – residents and entrepreneurs, authorities, tourists, etc. Firstly, good transport solutions determine the level of social, economic and even political inclusion of residents. Well-organized transport affects the flow of traffic, increases the comfort of movement, staying in the city (e.g. when limited traffic zones are created) and, finally, the comfort of life (reduction of air and exhaust emissions, thanks to the implementation of low- or zero-emission solutions, decreasing noise, shortening travel time, improving road safety and reducing the degradation of road infrastructure).

The implementation of modern ICT solutions supporting the development of sustainable transport in order to optimize communication processes and population mobility is an extremely important direction of activities. In large Polish cities, multimodal passenger applications serve this purpose, which allow

real-time traffic monitoring. They allow you to determine how much time it actually takes to travel to a given place by a specific means of transport and, if necessary, decide whether to opt-out of using the car. The most advanced solutions allow a counteraction to the dominance of individual communication and promote alternative forms of mobility based on multimodal passenger transport systems (coordination of the entire displacement chain implemented by various means of transport with a combination of individual and public transport, e.g. in Park & Ride or Bike & Ride mode). None of the cities in question has this type of solution, although some have the dramatic consequences of excessive car traffic and cannot cope with the lack of parking spaces.

The results of discussions on opportunities and threats in the implementation of smart mobility principles, the participants identified a comparable number of favorable and unfavorable factors, but clearly assigned a higher weight to threats (Table 1.3).

According to the interviewees, sustainable, data-based transport is one of the main elements constituting the smart city. Even the medium-sized agglomerations face many problems that did not seem so large a few decades ago. Neglect in the quality and availability of public transport services in the small urban centers examined have strongly influenced the mobility behavior of residents. However, this can be seen as an opportunity: the creation of smart mobility frameworks should acquire at the same time an appropriate technical and digital infrastructure, as well as simultaneous actions to change the communication behavior of residents.

On the opportunities side, the interviewees pointed to environmental issues and socio-cultural changes. Lower hopes are associated with economic issues (they perceive them mainly in terms of increased costs at the first stage of implementation), political and – the least – technological factors (see Figures 1.1 and 1.2).

The most desirable solution, suggested by the participants of the debate, would be cooperation with telecommunications operators in the scope of analyzing the whereabouts of users of a given network and their mobility route. Nowadays, femtocells allow you to locate the user with an accuracy of 100 meters, so you can visualize and interpret traffic within the city. These data should be combined with data from other sources (motion detectors, electronic toll systems, traffic lights, tunnel management systems, cameras and speed cameras, and even weather systems). In public transport, ICT solutions should make digital tickets available online.

Table 1.3. Opportunities and threats to the implementation of smart mobility assumptions

Factor	Opportunities	Threats
Socio-cultural	<ul style="list-style-type: none"> • the improvement of mobility solutions • improved safety and quality of life • social interest in solutions known from large urban centers • lifestyle • education level and health awareness • demographic trends • promoting a healthy lifestyle 	<ul style="list-style-type: none"> • fear of a change in the scope of transport solutions used (resignation from private transport) • shortage of qualified staff (programmers, architects, planners) • lack of public confidence in modern transport solutions
Techno-logical	<ul style="list-style-type: none"> • new technologies • ICT development • market niche • patents, inventions and intellectual property protection • level of digital literacy in society • growing acceptance and interest in modern solutions in the field of urban bicycle systems and scooters 	<ul style="list-style-type: none"> • high technology competition on the international market (pressure on the costs of applied solutions, low profitability and low scalability of solutions and applications offered by local entrepreneurs) • technical base/condition of technical universities
Environ-mental	<ul style="list-style-type: none"> • reducing the number of vehicles • lower energy consumption • reduction of water and air pollution • technology that does not use harmful substances 	<ul style="list-style-type: none"> • potential increase in environmental risk by introducing unknown solutions • the increase in energy consumption associated with new needs • production of harmful waste during the operation of equipment
Economic	<ul style="list-style-type: none"> • development of (small and medium) high technology enterprises • reduction of costs related to utilization of pollution, crowds, noise, lack of parking spaces, losses in urban greenery, number of accidents and costs of treatment of victims • availability of funds for the development of environmentally friendly technologies • growing indicator of implementation and commercialization of innovative technologies • market size 	<ul style="list-style-type: none"> • costs of changes in the area of city architecture, communication solutions, new investments, purchase of new vehicles, development of the city bike system • the cost of experts (smart mobility issues) and programmers • low implementation rate and commercialization of innovative technologies
Political	<ul style="list-style-type: none"> • increase in technology development financing • developing a coherent strategy for the development of smart mobility on a national scale (indicating priority development directions) and European guidelines • national scientific and research base 	<ul style="list-style-type: none"> • funding for research in the field of smart mobility • no incentives for launching commercial enterprises with a large „know-how” contribution • lack of units supporting researchers in obtaining/financing patents • no legal regulations allowing for quick technology implementation

Source: Own elaboration based on the results of STEEP analysis.

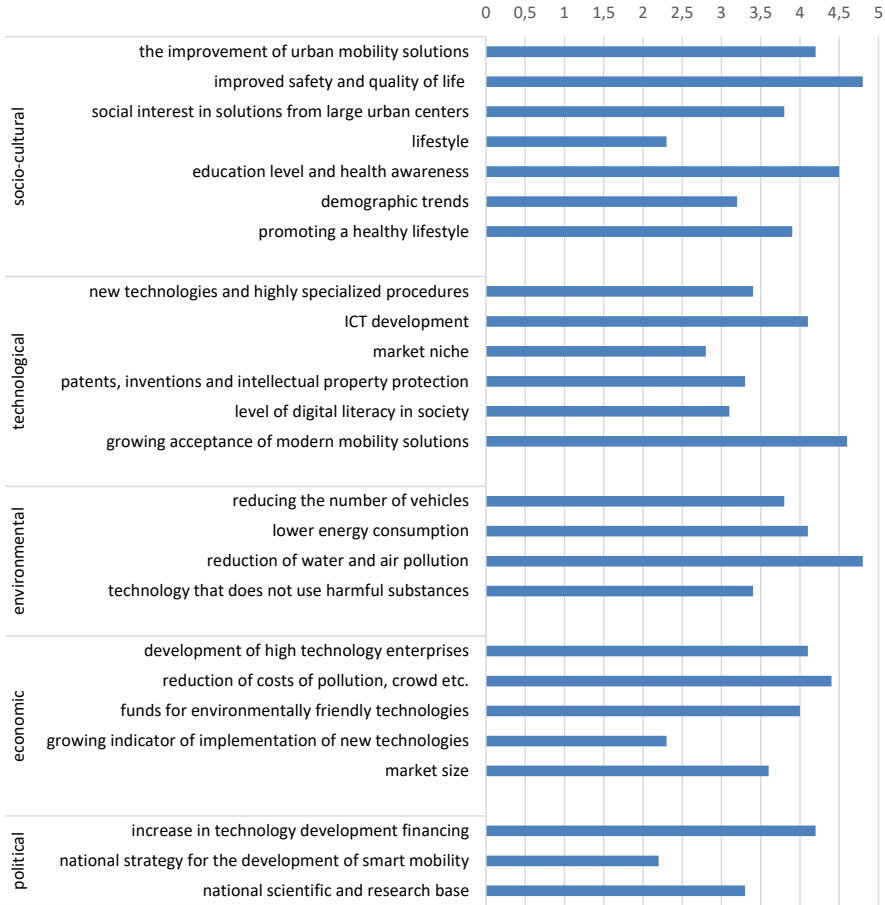


Figure 1.1. Opportunities for the implementation of smart mobility assumptions

Wireless Internet in public transport is an additional source of data for the passenger information system, which should inform a mobile application about, for example, the location of the nearest vehicle, the best available configuration of transport connections or available parking spaces (with the possibility of paying a fee). The application should also allow you to indicate the place where the car was parked, and to watch the car.

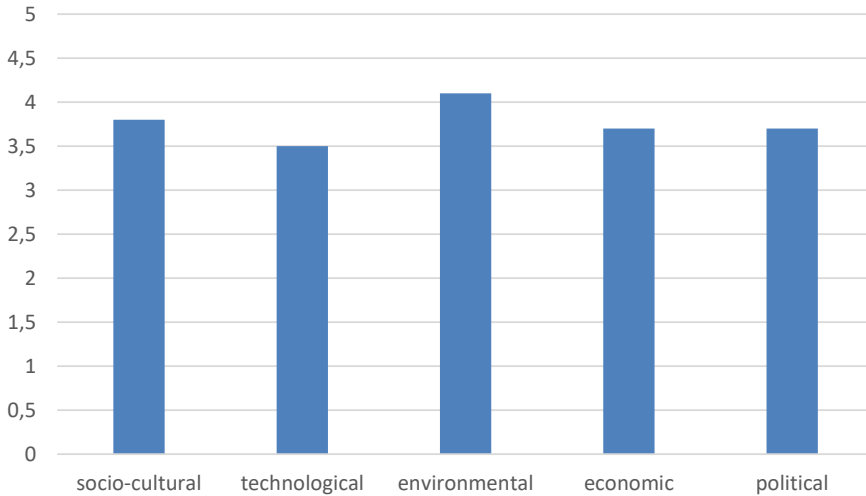


Figure 1.2. Key categories of opportunities for the implementation of smart mobility

Much higher weights were given to threatening factors, including in particular: technological and socio-cultural factors, which – in general – covered resistance to change, insufficient technological competence (including low universities support) and the lack of qualified staff (Figures 1.3 and 1.4). The main obstacle to implementing future-proof solutions is the lack of sufficient funds and the inability to communicate and cooperate with various institutions. Therefore, the implemented projects usually do not have a holistic approach, and in the field of transport, they most often amount to traffic regulation.

The majority of interviewees drew attention to the negative aspects of urban transport, having regard to both the effects in terms of its efficiency and environmental footprint. The concept of low efficiency covers both: the issues related to the costs of operating a car fleet and the costs of the user (time spent traveling, searching for parking, fuel costs, and vehicle depreciation).

According to interviewees, the negative impacts of the transport system covered: environmental impact (98%), congestion (time, cost) (100%), inefficiency (fuel, energy, vehicle) (76%), bad service public transport (82%), bureaucracy (11%), high cost of transport (39%), low safety (64%), automobile dominance (7%), lack of infrastructure (23%), uncertain future (12%), lack of intermodality (22%), “not smart” (67%), insufficient parking (94%), human factor/behavior (43%), level of motorization (23%), no sharing of resources (8%).

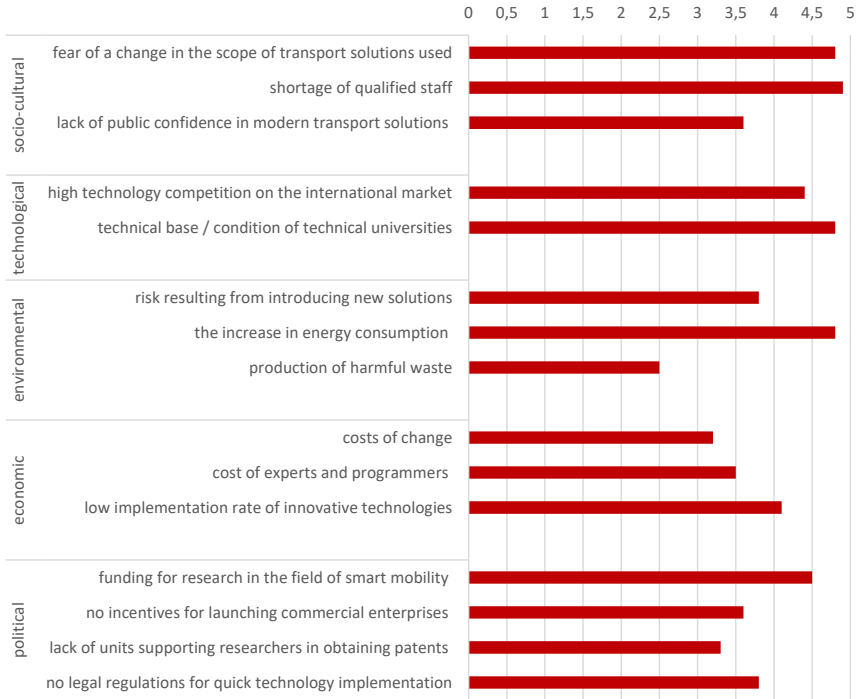


Figure 1.3. Threats to the implementation of smart mobility assumptions

Only a relatively small share of the interviewees suggested or hinted at the need for a change in thinking with respect to the human factor, lack of intermodality, no sharing of resources, or the dominance of the automobile as the most popular mode of travel. It is significant that some interviewees are looking for a solution to the problem of environmental pollution only in the implementation of autonomous vehicles (not including the type of fuel).

This solution raises even greater doubts when one considers the problem of traffic jams and the lack of parking lots – only one of the participants in the debate pointed out that without changing the habits of residents in terms of mobility, it will not be possible to reduce congestion or the number of road accidents. Even if modern cars are replaced by electric and autonomous cars, but on a one-to-one basis – most of the problems faced by cities will remain unsolved.

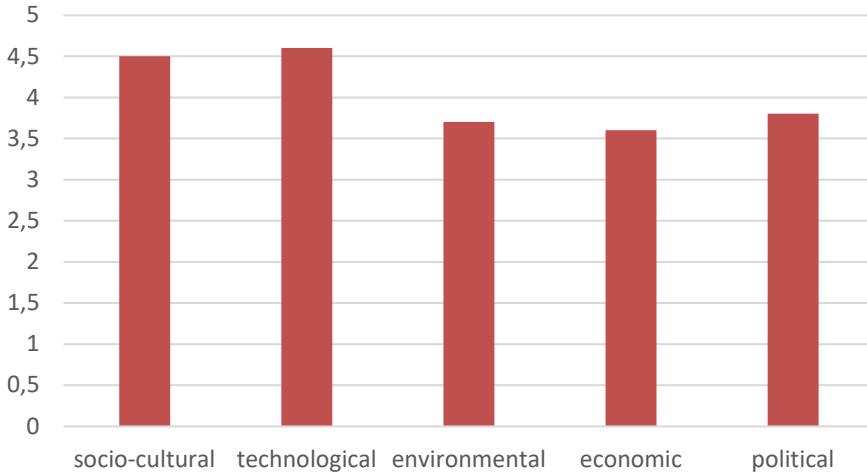


Figure 1.4. Key categories of threats to the implementation of smart mobility assumptions

6. Conclusions

The concept of smart cities in a simplified way consists in investments that are focused on sustainable economic growth of the city and improving the quality of life of the inhabitants. The most important thing is that they are to take place not only by the expansion of the broadly understood infrastructure (transport, ICT), but also one of the more important goals is to encourage the citizens living in the city to participate more fully in the life of the agglomeration.

On the side of factors favoring the implementation of smart mobility assumptions in the cities studied, the interviewees pointed out primarily environmental (climate crisis) and socio-cultural factors (in particular the feeling of a health threat and the desire to improve the quality of life, and openness to new, innovative forms of mobility). Unfortunately, political, economic and technological factors have been rated very poorly on the opportunities side, without which even the most aware local authorities will not be able to implement the concept of smart mobility.

In light of the literature review presented at the beginning of the article, in particular taking into account the leading elements constituting smart city and smart mobility, it is necessary to clearly emphasize the huge discrepancy between the theoretical assumptions and expectations of residents and city authorities and the technological possibilities of medium-sized urban centers.

The lack of financial support, as well as the lack of legal solutions and political programs conducive to new mobility, makes it impossible to take specific actions at the level of individual urban areas. Interviewees emphasized the gap between the largest Polish metropolises and medium-sized cities struggling with a shortage of finance and technological competence.

According to interviewees, there is a great need for in-depth research to identify the conditions for the transformation of current transport solutions to smart mobility. It also needs the identification of all stakeholders of this process and all data sources (ICT infrastructure and data analysis). It is equally important to conduct in-depth research as to the role of business entities in creating and stimulating the development of smart mobility while determining standards and minimum interoperability requirements.

The list of threats to smart mobility is consistent with these observations. By indicating the greatest threats, interviewees gave the highest importance to technological factors. In particular this included, the outflow of ICT staff to large cities, high technology competition on the international market (pressure on the costs of applied solutions, low profitability and low scalability of solutions and applications offered by local entrepreneurs) as well as the lack of a technical base (poor condition of technical universities). It is surprising, however, that despite indicating socio-cultural factors as an important element of opportunities, they also gave high importance to the analysis of threats (4.5/5), emphasizing above all the fear of a change in the scope of transport solutions used (reluctance to give up private transport) and lack of public confidence in modern transport solutions. In this case, it is difficult to count on the support of central authorities, legal solutions or changes in EU policy – the only key to overcoming these problems is local policy.

The high cost of changes in the area of city architecture, communication solutions, new investment, new vehicles, development of innovative, and a sustainable mobility system will remain a challenge for city authorities and local business. On the economic and political risk side, the interviewees indicated the cost of experts and programmers, low implementation rate and commercialization of innovative technologies, and funding for research in the field of smart mobility. They also cited a lack of incentives for launching commercial enterprises with a large “know-how” contribution and deficiency of units supporting researchers in obtaining/financing patents as well as lack of legal regulations allowing for quick technology implementation.

There are many attempts and projects implementing elements of a smart mobility, but there is a lack of extensive empirical and methodological research showing how to design and implement the transformation process. Deficiencies in the methodology of transformation constitute a particular obstacle in the opinion of representatives of medium-sized cities, deprived

of access to funds similar to that of large metropolises, with a relatively poor network of ICT developers, experts and high-competent staff. The lack of modern technologies prevents the collection and processing of sufficient data, which is a condition for the development of smart mobility and the main factor in the process of maintaining the principles of interoperability, thanks to which it is possible to avoid unnecessary data redundancy while ensuring their integrity and consistency and ease of access and use.

Transformation process needs to be stimulated by business entities, supporting smart mobility development by providing modern solutions, generating new ideas, implementing technological innovations, investment financing, consulting and improving processes.

In future research, it would be desirable to target smart mobility experts in a wider range of fields, such as technology researchers, engineers, and frontline administrative officials related to smart cities. The leading indicators on the basis of digital data need to be developed to enable comparisons and progress to be measured.

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Biographical note

Magdalena Kachniewska, Ph.D., member of the Scientific Council of the Elbląg Canal Route and the Scientific Committee of the NETOUR Project (Network for Excellence in Tourism through Organizations and Universities). Chairwoman of the Council of the Foundation “The Vistula River Year” working for the coordination of tasks and activation of the community of the Vistula communes. Propagator of the concept of applying new technologies in tourism (member of the e-TravelForum Scientific Council, chairperson of the jury of the “New.Tech.New.Travel” competition). Gained her managerial experience in public and private institutions (the CEO of Efekt Hotel S.A, general director of hotels Best Western Krakow Premier and Express by Holiday in Krakow and a member of the Supervisory Board of the European Mortgage Fund managing 4 Polish hotels).

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Sectoral employment structure in central and eastern European countries compared to highly developed countries in the European Union

*Bianka Godlewska-Dzioboń*¹

Abstract

The aim of the article is to present the spatial diversity of the sectoral transformation of the employment structure in the countries of Central and Eastern Europe (CEE) in the period 2010–2018. The current level of development of the service sector in the EU is primarily a consequence of the political and economic conditions that have existed in these countries in recent decades. With today's changes in the global economy, related to the transition from industrial to post-industrial to informational phase of civilization, the adaptation processes of various economic structures are an important research issue. The result is a redevelopment of a sectoral economic structure in which industrial activity, a fundamental economic base in the industrial phase, gives way to service activities, especially related to the digital economy. Understanding the rules governing the evolution of the three-sectoral structure of employment in the countries of Central and Eastern Europe is an important problem both theoretically and practically. The author presents the mechanisms for changing the three-sector employment structure over time in the different countries of Central and Eastern Europe, finding not only the intensity of change but also their consistency. This approach shows one of the most crucial elements of the competitiveness of regional and national spatial systems.

Keywords: *employment, European countries, regional disparities, European Union, structural change*

¹ Bianka Godlewska-Dzioboń, Ph.D., Assistant Professor, Cracow University of Economics, Rakowicka 27, 31-510, Cracow, Poland, e-mail:godlews@uek.krakow.pl (ORCID ID: 0000-0001-9668-458X).

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1. Introduction

An inherent feature of a market economy is the continued competition between entities. The complexity of the structural economy and the non-linearity of its processes are of great practical importance in building the competitiveness of economies. These elements need continuous monitoring of structural change and further modernization of the economic structure to update socio-economic development strategies. Cross-sectoral links also play an important role in this process. The need for liquidity and uniformity of development processes in the economy is the coordination between the evolution of old sectors and the emergence of new ones. It is necessary to ensure the best degree and pace of the reallocation of resources between individual sectors. Currently, all economies depend on global economic processes that have recently entered a phase of transformation in various domains of social and economic activity, continuing at a previously unknown pace. This transformation also strongly affects the labor market by changing the rules of its functioning and deepening its internal polarization. Such a labor market is subject to constant changes and tensions, also affecting public institutions, conducting their mission and adapting measures and methods of action to the ever-increasing changes in the digitization of the economy. Traditionally, the structural characteristics of the economy are considered important in terms of its performance, unemployment, and earnings, as well as productivity and convergence (e.g., Diewert, 2015). The role of each sector is assessed, based on its impact on economic phenomena and, therefore, the best type of specialization is asked (e.g., McCann & Ortega-Argilés, 2011). Despite these efforts, little attention has been paid to examining the impact of employment structures on socio-economic cohesion and its various aspects.

The purpose of this article is to present the phenomenon of structural changes in the countries of Central and Eastern Europe. Changes in the subjective system will be analyzed to recognize the regularities of development in the three sectors and identify the factors. An essential element of the development of the sectoral employment structure is its analysis over time. One way, it shows the chronology of changes, while on the other, it allows them to link significant economic events, implement reforms or economic fluctuations. Analyzing the transformation in the sectoral employment structure for the countries of Central and Eastern Europe will find the most important moments of the increase in structural change in the labor market. Furthermore, it will show if the current processes related to economic integration and globalization have an impact on accelerating the pace of these changes and the similarity of the employment structures of ESVs with selected EU-15 countries.

2. Literature background

The phenomenon of structural changes and attempts to examine them is not a new problem in the literature. Research on the structures of the economy supplies a picture of the division of the economy into the main elements. Therefore, reflecting its state and trends in the division of production and labor. In this sense, the economy is a complex socio-economic system that can be considered multidisciplinary. For this work, the analysis of structural changes has been narrowed down to changes in the labor market and the sectoral employment structure. Due to the complexity, multifaceted nature and breadth of the problems of employment structures and their transformations, the literature on the subject contains works covering its various elements.

In studies of economic structures and labor market structures, a special role is assigned to sectoral analysis. Many studies use a three-elemental system, which is based on the classic theory of three sectors of the economy, formulated by Clark, Fisher, and Fourastié. This approach makes it possible to distinguish the three sectors in the economic structure: sector I (agricultural), sector II (industrial), and sector III (services). The works of Casella and Coleman (2001), Timmer (2009), and Alvarez-Cuadrado and Poschke (2011) are part of the research on structural changes in the various sectors of the economy and the focus on agriculture. The works on industrialization, i.e. the industrial sector, include the works of Kallioras and Petrakos (2010), and Šipilov (2013). In contrast, the work related to the services sector was analyzed by Langen (2001), Beyers (2005), Jensen (2008), Uppenberg and Strauss (2010), Costa, Palma, and Costa (2013) and Falk and Peng (2013).

The end of the twentieth and early twenty-first century has been a technological breakthrough, as a result of which it led to a paradigm of development towards a knowledge-based economy. The consequence is an increase in the importance of research on the redevelopment of structures including employment to the rank of the most important phenomena in the modern world economy. This transformation is expressed as the displacement of industrial civilization by post-industrial civilization. This is linked to economic evolution and the need to modernize a change that improves the efficiency of actions and benefits society (Kleer, 2012). S. Kuznets, a winner of the Nobel Prize in Economics, and H. Chenery, contributed to the development of structural change. Both authors saw changes in the structure of the economy as part of its steady growth. The construction of structural changes, then focusing on phenomena such as globalization and decentralization, is linked to Stiglitz (2004). The pragmatic tone of systemic transformation is also proposed by Sadowski (2005). He argues that the recognized objective of these changes is to bring the regime closer to the economically developed countries of the world

by introducing a market economy based on a democratic political system, the fundamental determinant of which is far-reaching institutional transformation. To this end, comparative studies are carried out on the employment structures of one country compared to other countries (regions), but these are mainly surveys in three sectors (agriculture, industry, services) due to the availability and comparability of statistics.

One of the many aspects describing employment structures is also sector or industrial relations. The contemporary phase of structural changes in developed countries is characterized by the service and knowledge-based models. It also can be described through deindustrialization, tertiarization, and sterilization of the economy (De Backer, 2015). According to the analysis carried out by Markowska and Sokołowski (2019), the literature also includes works on the interpenetration of sectors: sterilization of industry (Gebauer, 2007; Francois & Woerz, 2008; Bryson & Daniels, 2010; Lodefalk, 2010), of business services as a factor of production (Drejer, 2002), and the importance of services in the manufacturing industry (Miles, 2005; Neely, 2008; Lay, Copani, Jäger, & Biege, 2010). Structural modernization can also be understood as the development of high-tech and knowledge-based industries. This pattern of change is seen in the EU, since employment in services, mainly in knowledge-intensive services, systematically increases its participation. Although agriculture and industry remain important sectors of the economy, the value of production growth is thanks to knowledge. A special feature of these changes is the high employment, production, and productivity dynamics of industries that involve human capital, use modern technologies (mainly information and communication technologies – ICT), participate in innovation networks, and invest in intangible resources. As Henning points out (2020), empirical evidence also highlights the integration of resources between high-skill manufacturing HI-M and knowledge-intensive business services KIBS. The results of these studies show the need to conceptualize and measure regional structural changes, as there is no clear transition of workers from production to services. This exchange suggests a cross-skill relationship, especially between high-tech production and KIBS, but in specific regions. This is particularly true for concentrated regions, as changes in employment in business services are more significant for metropolitan centers than in peripheral ones. This entails the need to compensate not only for the decline in production employment but also for the migration of experienced and skilled workers from production to the business services sector and from the outermost regions to the centers. It is also the focus of active regional politics. Indeed, stakeholders from emigrated regions are actively looking to reduce external mobility at the local and regional level, and stakeholders from areas using external professionals promote jobs in their area for all skilled workers.

To reconcile the different, often contradictory interests of the different regions; it is necessary to carry out and coordinate actions to address the negative effects of brain drain, e.g., supporting citizens in improving skills or strengthening two-sided partnerships between regions. Lavopaa and Szirmai (2020) equivalently assess this way. Their analysis shows that the expansion of the size of the modern service sector without the process of technology absorption is not enough to ensure stable growth. Conversely, reducing the technology gap in just a few sectors will lead to an enclave economy that is predestined to stagnation. It should be emphasized, however, that in studies on the assessment of structural changes, a deep disaggregation of collective data describing the economies of countries is important. The beginnings of new phenomena and tendencies announcing fundamental structural changes appear, not only at the lowest level and at the aggregation level, but above all, they occur initially on a small scale, only to change the target structure relatively quickly.

The literature review shows that research on structural changes in the labor market includes various elements. This is due to the specificities of sectoral mechanisms and the search for recommendations for an economic strategy to accelerate the transition of modern advanced economies to knowledge-based economies. Besides, preparing the economy for the needs of the future requires a deep analysis of its construction to look for branches on which future problems arising from the next phases of scientific and technical progress will depend.

3. Methodological approach

Quantitative testing methods were used to achieve the article's goal. The research was based on advanced statistical analysis, the essence of which is a comparison of the sectoral structure of employment in time and spatial terms, the identification of the dynamics of structural transformations, as well as the assessment of the direction of their transformation. To assess the similarity of structures in time and spatial terms, measures of the structural similarity of objects were used, as well as measures allowing the analysis of the intensity of structural changes within employment in the studied countries. The assessment of the direction of change in the sectoral employment structure is the first important research phase. The basis for comparative studies of this structure over a specified period is n observation matrix $x_{i,j}^t$:

$$X = [x_{i,j}^t] = \left\{ \left[\begin{array}{cccc} x_{1,1}^1 & x_{1,2}^1 & \cdots & x_{1,r}^1 \\ x_{2,1}^1 & x_{2,2}^1 & \cdots & x_{2,r}^1 \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1}^1 & x_{m,2}^1 & \cdots & x_{m,r}^1 \end{array} \right], \left[\begin{array}{cccc} x_{1,1}^2 & x_{1,2}^2 & \cdots & x_{1,r}^2 \\ x_{2,1}^2 & x_{2,2}^2 & \cdots & x_{2,r}^2 \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1}^2 & x_{m,2}^2 & \cdots & x_{m,r}^2 \end{array} \right], \dots, \left[\begin{array}{cccc} x_{1,1}^n & x_{1,2}^n & \cdots & x_{1,r}^n \\ x_{2,1}^n & x_{2,2}^n & \cdots & x_{2,r}^n \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1}^n & x_{m,2}^n & \cdots & x_{m,r}^n \end{array} \right] \right\}$$

$$\left(\begin{array}{l} i = 1, 2, \dots, m \\ j = 1, 2, \dots, r \\ t = 1, 2, \dots, n \end{array} \right) \quad (1)$$

where:

m – number of objects,

r – number of elements of the structure,

n – the number of units of time.

Assuming that the data in the matrix (1) are expressed in absolute values, the comparative analysis of the structures required a correct normalization procedure for the examined variables to ensure their comparability (Malina, 2004). The normalization was performed according to the following formula:

$$u_{i,j}^t = \frac{x_{i,j}^t}{\sum_{j=1}^r x_{i,j}^t} \quad (2)$$

where:

$u_{i,j}^t$ - value of j - structure element for i - object and t - time, assuming that the following conditions are met (Wydymus, 1998):

$$u_{i,j}^t \in \langle 0,1 \rangle, \quad (3)$$

$$\sum_{j=1}^r u_{i,j}^t = 1, \quad (4)$$

$$\sum_{i=1}^m \sum_{j=1}^r u_{ij}^t = N. \quad (5)$$

where: $N = m * r$

The analyses use economic structures whose components are equity indicators and add up to unity, therefore, they become self-standardized and standardized indicators that measure the relative intensity of a particular characteristic in structure elements (Strahl, 2014). As a result, the values of standardized matrix variables (1) for a sectoral employment structure composed of r sub-components for m countries and n years can be presented in the form of a matrix U , as expressed by the following formula:

$$U = [u_{i,j}^t] = \left\{ \left[\begin{matrix} u_{1,1}^1 & u_{1,2}^1 & \dots & u_{1,r}^1 \\ u_{2,1}^1 & u_{2,2}^1 & \dots & u_{2,r}^1 \\ \vdots & \vdots & \ddots & \vdots \\ u_{m,1}^1 & u_{m,2}^1 & \dots & u_{m,r}^1 \end{matrix} \right], \left[\begin{matrix} u_{1,1}^2 & u_{1,2}^2 & \dots & u_{1,r}^2 \\ u_{2,1}^2 & u_{2,2}^2 & \dots & u_{2,r}^2 \\ \vdots & \vdots & \ddots & \vdots \\ u_{m,1}^2 & u_{m,2}^2 & \dots & u_{m,r}^2 \end{matrix} \right], \dots, \left[\begin{matrix} u_{1,1}^n & u_{1,2}^n & \dots & u_{1,r}^n \\ u_{2,1}^n & u_{2,2}^n & \dots & u_{2,r}^n \\ \vdots & \vdots & \ddots & \vdots \\ u_{m,1}^n & u_{m,2}^n & \dots & u_{m,r}^n \end{matrix} \right] \right\} \quad (6)$$

The matrix (6) can be the basis for further analyses on the quantification of distance and similarity with other standardized economic structures, both in terms of time and spatial terms.

To assess the similarity of structures between the i - these k - this object ($i, k = 1, 2, \dots, m$) during t , the Hamming metric (urban distance) (Grabiński, 1984) was used, marked with the formula:

$$s_{ik}^t = \frac{1}{r} \sum_{j=1}^r |u_j^t - u_k^t|, \quad (7)$$

The structure similarity measure s_{ik}^t , calculated by formula (7) should be considered as a method of synthetic expression of distances of the sectoral employment structures compared between the i - these and k - this country. The values of these measures mean that the higher (lower) the value of these measures, the closer (farther) the analyzed country is to the reference object. The following measure was used to assess the intensity of changes in the sectoral employment structure between the t - this and n - this period for m objects (Grabiński, 1984):

$$D_t = \frac{1}{(m-1)} \sum_{i=1}^m \left(\frac{1}{n-1} \sum_{t=1}^{n-1} \left| \frac{S_{i,k}^{t+w} - S_{i,k}^t}{S_{i,k}^t} \right| \right), \quad (8)$$

where:

$$i, k = 1, 2, \dots, m, t, w = 1, 2, \dots, n,$$

D_t , - index of intensity of changes in the sectoral structure of employment between the t – this and $(t + w)$ – this period; the higher (lower) its value, the stronger (weaker) the structural changes over time.

3.1 Research area

The subject of the research is the sectoral structure of employment in the following economies, which is one of the most important economic structures and labor market. It concerns mainly changes in employment occurring in the three aggregating arrangements of the departments (sections) of the national economy, called sector I (agricultural), sector II (industrial – industry and construction), and sector III (service). Research entities are the economies of the selected Member States of the European Union, i.e., Czech Republic, Estonia, Lithuania, Latvia, Poland, Slovakia, Slovenia, and Hungary. The choice of central and eastern European countries is due to their regional, historical, and economic similarity. Data on the employment structure in the European Union countries are derived from the reporting data collected by Eurostat and the OCED between 2010 and 2018. Based on these data, it can be concluded that over the past ten years (2010–2018), employment in selected countries increased by 2671.07 thousand people from 30040.66 thousand in 2010 to 32743.5 in 2018, up 7%. Hungary saw the largest increase of 16% and the smallest increase was in Slovenia at around 1.5%. The increase in total employment is accompanied by a decrease in employment in agriculture, while in services and industry there was an increase. In 2010, 2,706 people were employed in the agricultural sector and in 2018, 2,239 were employed. It was different in the other two sectors. In the industrial sector in 2010, employment reached 951,352 and in 2018 there was an increase of approx. 12% and amounted to 10,661.25 thousand. A comparable situation took place in services where 17,820.77 thousand people worked in total in 2010, and 19,483.28 thousand in 2018. When analyzing employment in the EU, it is worth mentioning the most developed countries. The largest number of employees was in Germany that had 38.5 million in 2010 and 41.7 million in 2018, followed by Great Britain (29.5 and 32.2 million respectively), France (26.5 and 27.1 million respectively) and Italy (23.0 and 23.1 million).

4. Results and discussion

4.1. Directions of the change of sectoral employment structure in the countries of Central and Eastern Europe studied

The development of economies is determined primarily by the ability to use emerging opportunities and search for innovative solutions, not only technological or production. The processes taking place globally in the economy, as well as the situation on the labor market, often determine the direction of development. The breakthrough structural changes in the economies of Central and Eastern Europe resulted from the socio-economic transformation. This process has affected the economic development of the various countries of the Central and Eastern Europe region in diverse ways, thereby taking a different view on the state and quality of the basic economic structures. Then details are shown in Table 1.4.

Table 1.4. Changes in the sectoral structure of employment in the studied countries of Central and Eastern Europe in 1993–2003 (percentage points)

Countries	Economic sectors				
	Agricultural sector	Industry sector	Services sector	Market services sector	Non-market services sector
Czech Republic	-3.2	-3.1	6.3	5.1	1.1
Estonia	-9.8	-2.6	12.3	8.1	4.2
Lithuania	-7.1	-0.3	7.3	4.7	2.6
Latvia	-3.6	1.8	1.8	6.0	-4.2
Poland	-7.5	-2.9	10.4	7.8	2.6
Slovakia	-4.7	-1.7	6.4	5.7	0.7
Slovenia	-2.3	-7.3	9.5	6.5	3.0
Hungary	-3.7	-0.4	4.1	4.8	-0.6
Central and Eastern Europe	-5.2	-3.2	8.2	6.3	1.8

Source: Own study based on Eurostat data.

These data show that the share of the service sector increased in all countries of Central and Eastern Europe and amounted to 1.8 percentage points in Latvia to 12.3 percentage points in Estonia. In 2003, the percentage of people working in services was, on average higher than in 1993 by 8.2 percentage points. If we take into account the situation in Poland, the role of market services has become much more pronounced, the share of which in total employment increased by 10.4 percentage points, which is approx. 2 percentage points more than the

CEE countries average. The reverse trend, compared to the services sector, was observed in the participation of workers in the agricultural and industrial sectors. Their share in all surveyed countries decreased by 5.2 percentage points, but in some countries, such as the Czech Republic and Estonia, by approx. 10 percentage points, and in Poland and Lithuania by approx. 7 percentage points. In the industrial sector, in the analyzed period, there was also a significant decrease in the percentage of employed persons, which amounted to an average of 3.2 percentage points. In individual countries, these changes ranged from -0.3 percentage points (Lithuania) to -8.5 percentage points (Bulgaria). The only country that increased the share of industry in total employment was Latvia (an increase of 1.8 percentage points). The reason for the differences in the rate of change in the percentage of people working in the industry may be disproportional in the level of the percentage of employees between individual countries. In these sectors, Poland stands out from other CEE countries, recording a faster rate of intensity of changes in the sectoral structure of employment, especially in services (increase by 10.4 percentage points) and agriculture (decrease by 7.5 percentage points). The percentage of people employed in the industrial sector decreased by only 2.9 percentage points, which is due to the industrial policy of our country in this area.

The next phase of transformations in the labor markets of Central and Eastern European countries resulted in a further reduction of employment in agriculture and an increase in the role of the service sector. However, they were not as noticeable as it was in the previous period.

Table 1.5. Sectoral structure of employment in the surveyed countries of Central and Eastern Europe in 2010 and 2018 (%)

Countries	Year 2010			Year 2018		
	Agricultural sector	Industry sector	Services sector	Agricultural sector	Industry sector	Services sector
CEE	9.0	31.2	59.3	6.8	32.6	60.6
Czech Republic	3.2	37.9	58.9	2.8	37.5	59.7
Estonia	4.2	31	65.1	3.3	29.8	66.9
Hungary	4.5	30.7	64.8	4.9	32.4	62.7
Latvia	8.8	24.7	66.4	7.2	25.9	66.9
Lithuania	8.6	19.9	71.4	6.9	21.1	71.9
Poland	13.0	30.3	56.6	9.5	31.6	58.7
Slovakia	3.2	37.1	59.6	2.3	36.5	61.2
Slovenia	8.7	32.4	58.7	5.4	33.1	61.5

Source: Own study based on Eurostat and OCED data.

Analyzing the data in Table 1.5, it can be seen that in the countries of Central and Eastern Europe in 2010, the average percentage of people working in the agricultural sector was 9.00%, in the industrial sector - 31.2%, and in the services sector - 59.3%. In the agricultural sector, the spread of employment shares was the highest and amounted to 28.3 percentage points. The lowest share of agriculture in total employment was recorded in the Czech and Slovak economies (3.2%), while the highest was in Polish (13%), Latvian (8.8%) and Slovenian (8.7%) economies. However, the last two economies are below the average sectoral employment structure in the analyzed Central and Eastern European countries. The diversity of employment shares in the industry was the lowest, amounting to 18 percentage points. The highest share of industry in total employment was recorded in the Czech (37.9%) and Slovak (37%) economies, while the lowest percentage of people working in the industry was in the Lithuanian economy (19.9%). The highest differentiation of sectoral shares in employment was seen in services.

A similar range of the percentage of the employed was in services between the examined Central and Eastern European countries and amounted to 14.8 percentage points. The Polish economy had the lowest share of services in total employment (56.6), while the highest share was the Lithuanian economy (71.4). The employment structure is similar in the Latvian (66.4%) and Estonian (65.1%) economies.

Not much has changed over the last 10 years. The highest average share of employees in the first of the assessed sectors (agriculture) concerns the Polish economy (9.5%) and the highest in these countries: the Czech Republic (2.8%), Estonia (3.3%), and Slovakia (2.3%). In the second sector (industry), the highest share of the percentage of employees was recorded in the Czech Republic and Slovakia. However, the lowest share was recorded in Latvia (25.9%) and Estonia (29.8%). In the services sector, the situation has not changed at all. The lowest share of services in total employment was recorded in the Polish economy (58.7%), while the highest was in the Lithuanian economy (71.9%).

Although the countries of Central and Eastern Europe cooperate intensively within the European Union, despite more than twenty years of structural changes, there is still a clear difference concerning the most developed EU countries.

Table 1.6. Share of employees in economic sectors in developed EU countries in 2010–2018 (%)

Country	Sector	Year		Change in years 1993–2013 (in percentage points)
		2010	2018	
Austria	Agriculture	5.2	3.7	–1.5
	Industry	24.9	25.4	0.5
	Service	69.9	70.9	1.0
Belgium	Agriculture	1.3	0.9	–0.4
	Industry	23.4	21.1	–2.3
	Service	75.3	78.0	2.7
Denmark	Agriculture	2.5	2.1	–0.4
	Industry	20.0	18.8	–1.2
	Service	78.9	74.0	–4.9
Finland	Agriculture	4.4	3.7	–0.7
	Industry	23.2	22.3	–0.9
	Service	72.4	74.0	1.6
France	Agriculture	2.8	2.5	–0.4
	Industry	22.1	20.0	–2.1
	Service	74.9	77.5	2.6
Germany	Agriculture	1.6	1.2	–0.4
	Industry	28.3	27.4	–1.1
	Service	70.0	71.4	1.4
Greece	Agriculture	12.4	12.4	0
	Industry	19.6	15.2	–4.4
	Service	68.0	72.4	4.4
Luxembourg	Agriculture	1.3	0.1	–1.2
	Industry	12.0	9.7	–2.3
	Service	86.7	90.2	4.5
Netherlands	Agriculture	2.7	1.8	–0.9
	Industry	16.1	14.6	–1.5
	Service	81.2	83.6	2.4
Portugal	Agriculture	11.2	6.1	–5.1
	Industry	27.3	24.8	–2.5
	Service	61.5	69.1	7.5
Spain	Agriculture	4.1	4.2	0.1
	Industry	22.9	20.3	–2.6
	Service	72.8	75.4	2.6

Country	Sector	Year		Change in years 1993–2013 (in percentage points)
		2010	2018	
Sweden	Agriculture	1.9	1.8	-0.1
	Industry	19.8	18.0	-0.2
	Service	78.0	80.1	2.1
United Kingdom	Agriculture	1.0	1.0	0
	Industry	19.0	18.0	-1.0
	Service	79.7	80.9	1.2

Source: Own study based on OCED data.

In the period 2010–2018, all EU-15 countries experienced further changes in the sectoral structure of employment and they were characterized by similar paths of economic development. As shown by the data in Table 1.6, in selected most-developed EU countries, the share of employment in sectors I and II decreased, while it increased in sector III. This tendency is the result of increasing the level of services, and the development of sector III as the most efficient. It should also be emphasized that there was a slight weakening of the role of sectors I and II, as they were both less effective than sector III. When discussing the shaping of the sectoral employment structure between the EU-15 economies in 2010–2018, it should be emphasized that these countries show greater similarities with each other. However, much stronger and relatively stable structural changes in employment occurred in 1993–2003.

The studies that consider the CEE countries show that EU membership had a positive impact on economic growth for these economies. It should be emphasized that the European integration practically cannot be separated from the systemic transformation, therefore, it is difficult to clearly distinguish the effects of this initial process, i.e. to assess the difference between the actual parameters of the CEE economies and the hypothetical scenario in which these countries would not join the European Union. A key role, apart from trade, was played by EU funds, whose economies have been the greatest beneficiaries for many years. The European Union is the most effective mechanism in the world for raising the standard of living of the population of less developed countries to the level of developed countries. World Bank economist Intermit Gill, who created the famous concept of the “middle-income trap,” called this mechanism “the European convergence machine.” It is a process by which economic and institutional integration leads to the rapid flow of technical knowledge and legal standards to help lower-productivity countries achieve higher-than-average labor productivity dynamics. The understanding of the mechanisms for changing the three-sector employment structure over time in the different countries of Central and Eastern Europe, it also allows us to

find the intensity of change. Figure 1.5 has the values of the measure of the intensity of structural change in the various countries of Central and Eastern Europe between 2010 and 2018. The analysis of changes in the three-sector employment structure in the region of Central and Eastern Europe shows that the greatest evolution took place in Estonia (intensity measure value equal to 0.1373), and Hungary (intensity measure value equal to 0.1246). It could have resulted from smaller disproportions and accelerated changes in these labor markets. The lowest rate of intensity of changes in the sectoral structure of employment was characteristic of the Polish economy, where the value of the intensity measure was equal to 0.0505. It should be emphasized, however, that this economy was characterized by a high pace of employment changes in sectors in the earlier analyzed periods (2000–2010). An accelerated pace of changes in this area occurred in two Baltic countries (Lithuania, Latvia) and in Slovakia and Slovenia. In these countries, the intensity of structural changes was remarkably similar and amounted to 0.08 value of the intensity measure.

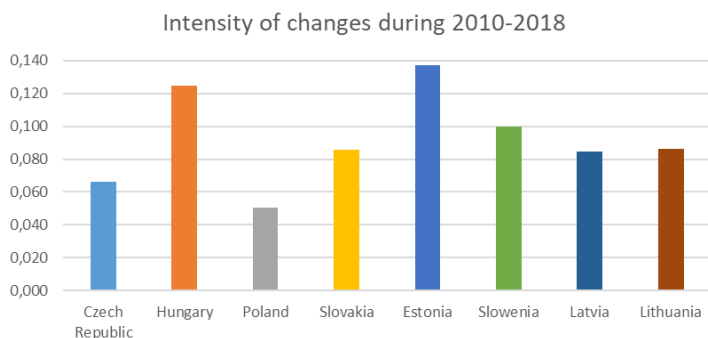


Figure 1.5. Values of the measure of the intensity of structural changes in the studied countries of Central and Eastern Europe in 2010–2018

Source: Own study based on OCED data.

Table 1.7 presents the values of the coefficient of variation of the intensity of changes in the three-sector employment structure in individual countries of Central and Eastern Europe in 2010–2018.

Table 1.7. Uniform intensity of changes in the three-sector employment structure in the studied countries of Central and Eastern Europe in 2010–2018

Countries	Standard deviation of structural change intensity	Average intensity of structural changes	Coefficient of variation of the intensity of structural changes (in %)
CEE	0.18	0.095	1.93
Czech Republic	0.17	0.07	2.48
Estonia	0.36	0.14	2.588
Hungary	0.36	0.13	2.83
Latvia	0.10	0.09	1.10
Lithuania	0.07	0.09	0.85
Poland	0.12	0.05	2.36
Slovakia	0.17	0.09	1.93
Slovenia	0.13	0.10	1.33

Source: Own study based on OECD data.

Based on the data on the dynamics of the intensity of structural changes, it can be concluded that the most diverse pace of structural changes occurred in Hungary. The Czech Republic, Estonia, and Poland constituted another group with an unstable rate of change intensity. The most stable pace of changes in the three-sector employment structure was characteristic of three countries: Lithuania, Latvia, and Slovenia. It is worth emphasizing that in these countries the changes in the three-sector employment structure were the most stable over time, therefore, the structural changes in the labor markets of these countries – compared to other Central and Eastern European countries – were the most predictable.

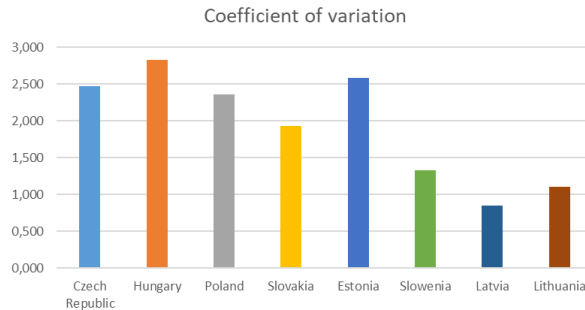


Figure 1.6. Coefficients of variation in the intensity of structural changes between Poland and other countries of Central and Eastern Europe in 2010–2018

Source: Own study based on OECD data.

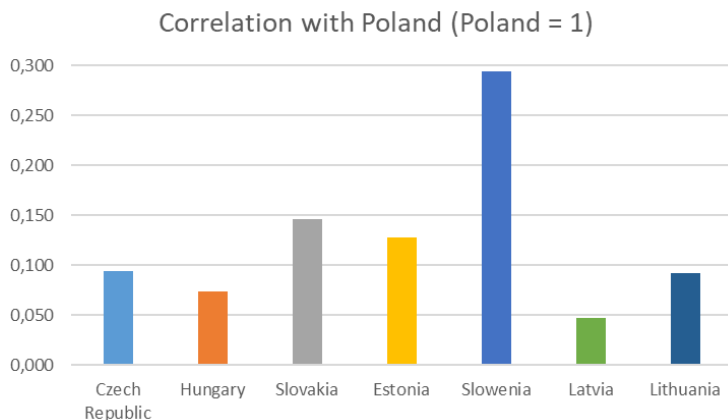


Figure 1.7. Comparison of the intensity of structural changes between Poland and other countries of Central and Eastern Europe in 2010–2018

Source: Own study based on Eurostat data.

By comparing the intensity of changes in the three-sector employment structure in Poland to other Central and Eastern European countries, the correlation coefficients were calculated, which are shown in Figure 1.7. These data confirm that the intensity of structural changes in Poland was most strongly correlated with the intensity of structural changes in Slovenia and Slovakia, and the weakest with the intensity of these changes in Lithuania and Hungary.

5. Conclusions

This study discusses the research findings on the dynamics of the sectoral transformation of employment in Central and Eastern European countries against the advanced countries of the European Union. This research is a continuation of the author's earlier research on this issue (see Godlewska-Dzioboń, 2019; Godlewska-Dzioboń, Klimczyk, & Witoń, 2019; Godlewska-Dzioboń, Klimczyk, & Witoń, 2018). The research covering ten years allowed the identification of key periods for the development of CEE economies, some of which were stimulating, and others were dissimulating. These include:

- 1) The period 1993–2003 was influenced by transformation, accession to the EU, and the last financial crisis and the period 2010–2018. The first two – transformation and accession to the EU – started the process of reducing the distance between the countries of Central and Eastern Europe and the most developed countries in terms of employment structures. It was the result of the systemic reforms and efforts to improve

economic efficiency, as well as the actions of the European Union aimed at cutting differences in the admission of new member states.

- 2) On the other hand, the period 2010–2018 shows the slowdown of the previously determined trend. These are partly the effects of the recent financial crisis, which was revealed in the negative synergy of feedback loops between the countries studied, leading to an antinomic, anti-development drift.

The conducted research has also shown that the similarity of economies and their components under similar preferences and technologies occurs much faster at lower stages of development, while it is much slower in more developed economies. This is also overlapped by disproportions that require deeper (often at the level of mentality) social and institutional changes. Currently, we are still seeing a decline in employment in the agricultural sector, but its dynamics are not too high. We also notice the growing importance of services in employment, which is forced by the development of civilization in the modern world. The importance of the industrial sector in CEE countries is also vital. This level of change is also noticeable in advanced countries of the EU. The surveyed countries experience a convergence in the employment structure, but the current divergence in the dynamics of change has weakened. This is due to the cohesion policy pursued, which aims to increase the wealth creation and opportunities for European regions and the people who live in them, as well as paying more attention to areas lagging in economic development. However, the number of activities and financial resources given to this activity should not only bring these countries closer but also significantly exceed their level. CEE countries have trouble in this regard. Therefore, a question arises about the further influence of the processes of globalization and economic integration on the tendency to equalize the levels of development. In addition, these problems highlighted the shortcomings of neoclassical growth models that sought its sources in capital accumulation and technical progress, without reflecting the intricacy and complexity of the dilemma in the economic reality (Kuźma, 2020). So, does this mean the failure of the existing cohesion policy? The answer is no, as all regions and sub-regions have experienced growth (understood as improvement in significant indicators). Nevertheless, these changes are not universal. The CEE countries, despite their geographic, historical, and economic similarity, are an area with large spatial differences, which are still growing in many spheres. Therefore, it contributes to the redefinition of the determinants of economic development, not only quantitative but also qualitative.

The results of the analysis may also form the basis for the assessment of the economic situation in the sectors analyzed, as well as to carry out further analyses aimed at analyzing the causes and trends in employment in selected sectors of the economy. With the aspiration of building a modern, coherent and complete

economy, the European Union will force decision-makers to set the directions for further streams of cohesion policy measures and to set investment priorities in order to implement them in a more flexible, efficient, and effective way.

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Biographical note

Bianka Godlewska-Dzioboń, Ph.D., Assistant Professor at the Department of Public Policies at the University of Economics in Krakow. Ph.D. in economics, degree obtained at the University of Economics in Krakow for the dissertation: Trends in sectoral changes in employment in new employees. An expert and trainer of research and implementation projects in the field of promoting academic entrepreneurship, e.g. Mountain Forum of the International Program Council. Deputy head of the research project entitled "Entrepreneurship and academic innovation - A model of cooperation between economic universities and employers." Coordinator of a project: Laboratory of Dialogue. Her research interests focus on the area of structural changes in the economy taking place in work with information and communication machines and globalization on the labor market.

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Global debt as a determinant of notional amounts outstanding changes of credit default swaps in non-financial institutions

Maria Czech¹

Abstract

The paper aims to determine the impact of global debt on the notional amounts outstanding of credit default swap contracts (CDS) used in non-financial institutions. CDS are innovative derivative instruments primarily used in credit risk management. In this study, the notional amounts outstanding of CDS concluded by non-financial institutions in 2005-2018 and the degree of involvement of non-financial institutions on the CDS market were examined, based on a dynamics analysis. The results of the analysis indicated that the share of non-financial institutions in the CDS market is decreasing due to the over-the-counter (OTC) market regulations introduced in 2010. Then, the effect of selected debt ratios on the CDS notional amounts outstanding was examined by means of multiple linear regression analysis. This analysis has established that the change in the size of global debt ratios determines the changes in the notional amounts outstanding of non-financial institutions CDS. The study confirmed a correlative relationship between global debt and the notional amounts outstanding of non-financial institution CDS. It has been proved that non-financial institutions are not interested in concluding CDS contracts in the conditions of increasing global debt. Despite the many possibilities of using CDS in non-financial institutions, up to now, these issues have rarely been included in research and studies. Based on a literature study, it was found that the issue of non-financial institutions CDS remains very poorly recognized. The study indicates that the use of CDS in non-financial institutions gives the possibility of managing global credit risk.

Keywords: *credit default swaps, credit risk, global debt, non-financial institutions*

¹ Maria Czech, Ph.D., Assistant, Department of Banking and Financial Markets, University of Economics in Katowice, ul. 1 Maja 50, 40-287 Katowice, Poland, e-mail: maria.czech@ue.katowice.pl (ORCID ID: 0000-0003-3572-6891).

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1. Introduction

Credit default swap contracts (CDS) belong to a group of credit derivatives. The underlying assets of these contracts are credit risk-related instruments, such as loans, revolving credit lines, bonds, and other debt instruments (Czechowska, 2010; Kasapi, 2002). CDS contracts are instruments for transferring credit risk between two counterparties. An entity that wants to hedge against credit risk (protection buyer) buys a CDS contract and simultaneously sells (transfers) the credit risk. This transaction protects the buyer of CDS from a loss associated with the bankruptcy of a debtor (reference entity), e.g. an issuer of debt securities. The other counterparty – protection seller (the entity assuming the credit risk) – sells the CDS contract and bears the consequences of the credit risk, in exchange for receiving a premium.

The mechanism of CDS contracts is based on two payment streams. The first one is a premium (spread). A premium is a periodic (usually quarterly) fee paid by a CDS buyer to the CDS seller. It is paid until the credit event occurs or until the maturity of the trade (O’Kane, 2011). The premium is expressed in basis points, paid on the nominal value of the CDS contract (Jajuga, 2009). The second payment stream is activated only after the credit event has occurred. A credit event is a situation that triggers the obligation to activate the protection and includes the bankruptcy of the debtor, the insolvency of the debtor, any changes in debt repayment (acceleration or delay in repayment), an announcement of a moratorium, and debt restructuring (Kothari, 2003). After the credit event, the CDS contract is physically, or cash-settled. In the physical settlement, the CDS buyer receives 100% of the notional amount of the CDS contract in exchange for the underlying assets delivery to the CDS seller. In the case of a cash settlement, the buyer of the CDS contract receives 100% of the CDS notional amount, which is reduced by the recovery amount², and leaves the underlying assets in its portfolio or sells them on the market. Both physical and cash settlement enables the buyer of the CDS to compensate for losses resulting from the debtor’s insolvency (Choudhry, 2003).

CDS contracts are traded on the over-the-counter (OTC) market. OTC is created by a system of direct relationships between its participants all over the world and it allows the negotiation of contract terms. It is an unregulated market with a high degree of liberalization. As a result, CDS contracts are traded in both financial and non-financial institutions. Non-financial institutions can act in the CDS market both as entities hedging against credit risk, as well as credit risk-takers for adequate remuneration.

One of the features of CDS contracts revealed as a result of the financial crisis is the assessment of sovereign debt. It has been proved that due to

² Recovery amount is the amount that can be obtained from the sale of an underlying asset after a credit event.

changes in the level of indebtedness of individual countries, the value of public debt-based CDS spreads (sovereign CDS, sCDS) changes. Consequently, observation of sCDS spreads gives the opportunity to assess the financial situation of individual countries (Pyka & Czech, 2018).

Research to date has shown the correlation of sCDS spreads to the level of sovereign debt (Czech, 2019a), but no evidence has been found of a relationship between the level of debt and the CDS contracts notional amounts outstanding of non-financial institutions. Therefore, the main objective of this study is to determine the impact of global debt on the notional amounts outstanding of CDS contracts concluded by non-financial institutions. The results of the study will answer the question of whether the activity of non-financial institutions on the CDS market is determined by changes in the level of global debt. Achieving the main goal will be helped by specific objectives, which include indicating the possibility of using CDS in non-financial enterprises and determining the size and type of CDS transactions concluded by non-financial institutions. This study aims to introduce the issues of the CDS market to non-financial institutions and identify the benefits and risks of their use.

2. Literature background

The paper is based on a literature study, the results of which show that the market for CDS contracts concluded by non-financial institutions is very poorly recognized. The source literature provides many studies related to the credit derivatives market, but at the same time shows a large shortage of the scope of studies that would focus mainly on non-financial institutions and their activity on this market. A key aspect of the available publications is the characteristics of particular types of credit derivatives (including Credit Default Swaps, Credit Spread Options, or Collateralized Debt Obligations) and their classification and valuation (Aniston, Fabozzi, Choudhry, & Chen, 2004; Chaplin, 2010; Choudhry, 2010; Cherny & Craig, 2010; Czech, 2013; D'Arcy, McNichols, & Zhao, 2009; Das, 2000; Fabozzi, Mann, & Choudhry, 2003; Grodzicki, 2012; Huterska, 2010; Jackowicz, 2001a; Schwarz, Gibney, Haworth, Somaia, & Ali, 2010). A significant proportion of researchers consider the development of the credit derivatives market, especially the credit default swap market (D'Arcy et al., 2009; Pawliszyn, 2004; Pruchnicka-Grabias, 2011).

The leading problem in the source literature is the application of credit derivatives, and in particular the employment of CDS contracts (Czech, 2019b; Das, 2000; Grontecki & Kurnatowski, 2007; Jackowicz, 2001b; Karkowska, 2005; Kasapi, 2002; Kiff & Morrow, 2000; Marcinkowska & Wieteska, 2007; Meissner, 2004; Niedziółka, 2007a, 2007b; Puszer, 2012; Pyka & Czech, 2013; Siciński, 2013; Zaleska, 2007).

The results of the literature analysis showed that much more attention was paid to the use of CDS in hedging and speculation, while the problem of using these instruments in arbitration was much less frequently discussed. It was pointed out that a feature of CDS contracts is the transfer of credit risk, which, on the one hand, gives the opportunity to reduce or eliminate credit risk, and on the other hand, allows it to be taken over for appropriate remuneration (Chaplin, 2010; Choudhry, 2010; Corzo Santamaría, Gómez Biscarri, & Lazcano Benito, 2014; Dieckmann & Plank, 2012; Duffee & Zhou, 1999; Gwizdała, 2013; Olszak, 2006).

Since the financial crisis in 2008, the mainstream research on the CDS market has been the ability of these instruments to reflect the economic fundamentals (including debt) in CDS spreads based on public debt (sovereign CDS, sCDS) (Adt-Sahalia, Laeven, & Pelizzon, 2014; Demirgüç-Kunt & Huizinga, 2010; Eichengreen, Mody, Nedeljkovic, & Sarno, 2012; International Monetary Fund, 2013; Mayordomo, Peña, & Schwartz, 2014; Norden & Wagner, 2008; Piotrowski & Piotrowska, 2013).

In recent years, however, research on the interdependence of sCDS spreads with other financial assets have become an increasingly important area of interest (Blanco, Brennan, & Marsh, 2003; Credit Suisse, 2010; Da Fonseca, Ignatieva, & Ziveyi, 2016; Hull, Predescu, & White, 2004; Norden & Weber, 2009; Palladini & Portes, 2011; Zhu, 2004; Zhang, Zhou, & Zhu, 2005).

The studies compared bond yields and changes in CDS spreads in order to determine the effectiveness of these instruments in absorbing information about changes in the real economy. Issues concerning factors influencing CDS spreads were also addressed, which included: inflation, public debt to GDP, risk-free interest rate, exchange rates or stock indices (Aizenman, Hutchison, & Jinjara, 2013; Czech, 2019a, 2019b; Fontana & Scheicher, 2016; Liu & Morley, 2012; Pyka & Czech, 2018; Yuan & Pongsiri, 2015).

One of the most important areas of interest for researchers of the credit derivatives market (including credit default swaps) is valuation methods and models. A set of derivative valuation models was distinguished, such as insolvency models based on credit spreads, on ratings, and other (Hilscher, Pollet, & Wilson, 2015; Hull & White, 2000; Jakubowski, 2006; Jurkowska, 2014; O’Kane & Turnbull, 2003; Sundaresan, 2012).

The results of the conducted literature study indicate that in the source literature, the issues of CDS contracts of non-financial institutions do not occur. Therefore, a research gap has been shown that prompts research on the trends and market dynamics of non-financial institutions CDS contracts and prompts to determine the impact of global debt on the value of this market.

3. Research approach and methods

The purpose of this study is to determine the directions and dynamics of the market development of CDS contracts concluded by non-financial institutions, as well as to examine the impact of global debt on the notional amounts outstanding of non-financial institutions CDS contracts. The research period (covering the years 2004–2018) is determined by the availability of statistical data. The first statistical data of the CDS notional amounts outstanding of non-financial institutions were available on 31 December 2004. The latest data – the most current as at the date of this article – were available on 31 December 2018.

The study used the Bank for International Settlements (BIS) database, which expresses the CDS notional amounts outstanding (in billions of dollars), as on the last day of June and the last day of December each year. Notional amounts outstanding are market size indicators, specifying the total value of all open and unsettled CDS contracts, concluded by non-financial institutions. The BIS defines the notional amounts outstanding as “the nominal or gross nominal value of all transactions concluded and outstanding at the reporting date.” Notional amounts outstanding are, therefore, the same as the nominal value of the underlying assets of CDS. The application of this measure determines the size of the market and its ability to transfer risk.

The implementation of the objectives of the study is based on a critical analysis of the source literature and on quantitative research. The literature studies allow an explanation of the essence of CDS. The quantitative studies use statistical methods: dynamics analysis and regression analysis.

The dynamics analysis includes the analysis of the time series of the notional amounts outstanding of CDS contracts concluded by non-financial institutions. The use of this tool allows showing the changes taking place on the non-financial institution CDS market during 2004–2018.

At the beginning, a linear multiplicative model of the time series (CDS notional amounts outstanding of non-financial institutions) was built and decomposed. The main trend was identified by an analytical method, which was described by the formula:

$$\hat{Y} = b_1 * t + b_0 \quad (1)$$

where: \hat{Y} – trend; b_0 i b_1 – model parameters; t – time

The trend function determines the development of the CDS notional amounts outstanding of non-financial institutions in relation to the time variable. The parameters of the trend model are estimated using the least squares method (LSM):

$$b_1 = \frac{n \sum_t^n y_t * t - \sum_t^n y_t * \sum_t^n t}{n \sum_t^n t^2 - (\sum_t^n t)^2} \quad (2)$$

$$b_0 = \bar{y} - a t^-$$

where:

y_t – CDS notional amounts outstanding of non-financial institutions in the period t ,

t – number of consecutive time units,

\bar{y} – average CDS notional amounts outstanding of non-financial institutions in the period t ,

t^- – average value of time units.

The trend in changes occurring on the market for medium-term CDS was estimated with reference to a time variable and allowed the determination of the direction of changes. The dynamics of the change on the CDS market was explored by average pace of change and was described by the formula:

$${}^{n-1}\sqrt{\frac{Y_n}{Y_1}} - 1 \quad (3)$$

where:

y_1 – CDS notional amounts outstanding of non-financial institutions in the period 1,

y_n – CDS notional amounts outstanding of non-financial institutions in the period n ,

$n - 1$ – the number of observations reduced by 1 (which results from the construction of chain indexes).

Based on the analysis of the dynamics, the non-financial institutions' activity on the CDS market has been determined. To that end, the notional amounts outstanding in the CDS purchase and sale transaction of non-financial institutions have been examined.

As a part of feature dependency analysis, multiple linear regression analysis was used, conducted in Statistica 13. The purpose of the analysis was to examine the correlation between the level of the CDS notional amounts outstanding of non-financial institutions and the global debt level. The analysis was conducted on a sample of 145 observations of concluded and unsettled CDS transactions and selected global debt ratios, during 2004–2018 (at half-yearly intervals). The dependent variable is the CDS notional amounts

outstanding of the non-financial institutions. The independent variables (predicated variables) are the following debt ratios:

- bank credit to the private non-financial sector (as a percentage of GDP);
- total credit to households (as a percentage of GDP);
- total credit to non-financial corporations (as a percentage of GDP);
- total credit to the government sector at nominal value (as a percentage of GDP).

The values of individual indicators were obtained from the BIS database. The indicators are aggregated data on selected economies around the world, both the advanced and emerging market economies: Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Euro Zone, Hong Kong, Hungary, India, Indonesia, Israel, Japan, Korea, New Zealand, Norway, Malaysia, Mexico, Poland, Russia, Saudi Arabia, Singapore, South Africa, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States. Due to the fact that the size of debt ratios is given in annual periods, for the needs of the model, it was assumed that in each half-year of the given year, these values are the same as given in the BIS database for the whole year.

In the analysis of multiple linear regression, the method of progressive stepwise regression was used. All the above-mentioned indicators were taken into account in the model construction, but only those that were statistically significant were introduced to the model. The statistical significance was assessed by means of the t-test, assuming a maximum 5% chance of making an error in conclusion. Therefore, those variables whose value was higher than the critical value resulting from the Student's t-distributions at the $\alpha < 0.05$ level were considered statistically significant. Then, after including all statistically significant variables in the model, the linear significance for the whole built model was examined with the use of test F statistics.

The estimated model of linear multiple regression was described by the equation:

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \quad (4)$$

where: b_i – are partial regression factors, model parameters representing independent variables affecting the CDS notional amounts outstanding of the non-financial institutions.

The use of a multiple linear regression model has allowed the answer to the question of whether the CDS notional amounts outstanding of non-financial institutions changes under the influence of changes in global debt.

4. Results and discussion

In analyzing the non-financial institutions CDS market, it was noticed that the greatest interest in these instruments took place in the years 2004–2009 (Figure 1). In the second half of 2009, the notional amounts outstanding of the examined CDS contracts increased by over 209% compared to the second half of 2004. The key factor of the increase of the CDS notional amounts outstanding of non-financial institutions until 2008 was the intensive increase in the level of credit risk in the USA, caused by excessive lending on the subprime mortgage market. In the United States, until 2008 (the outbreak of the financial crisis), mortgage loans were massively offered to people with no creditworthiness assessment, and then credit risk was transferred (Niedziółka, 2011a). The strategy adopted by financial institutions allowed the transferred credit risk to be taken over by non-financial institution, for which the credit market was previously closed. The results of the study prove that there was a relatively high need to trade credit risk in non-financial institutions. Since the second half of 2004, the notional amounts outstanding of the examined CDS contracts increased from half-year to half-year on average by 11.95%, from USD 523 billion of USD to 1,617 billion USD in the second half of 2009 (Figure 1.8).

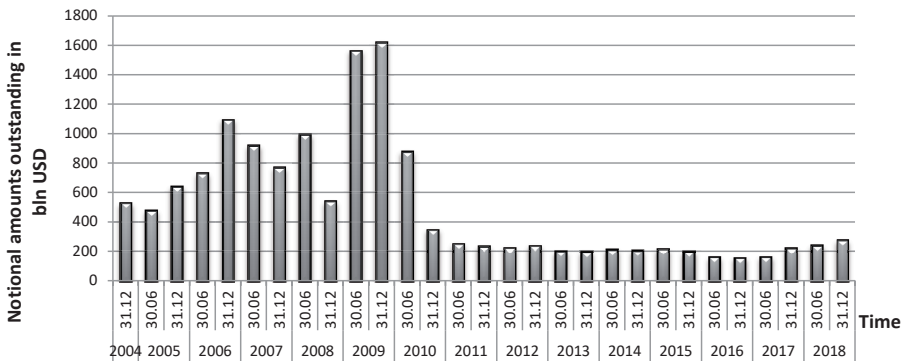


Figure 1.8. Notional amounts outstanding of non-financial institution CDS, in 2004–2018

Source: Based on BIS, OTC derivatives statistics, 2004–2018.

An analysis of the trend of the notional amounts outstanding of CDS contracts concluded by non-financial institutions in 2004–2018 shows that despite increases in the initial research period, the direction is downward.

The main trend, isolated on the basis of a time series of notional amounts outstanding of the examined CDS contracts, is described by the formula:

$$\hat{Y} = -29,984 * t + 945,62 \quad (5)$$

The result indicates that the notional amounts outstanding of CDS contracts of non-financial institutions decreased by USD 29,984 billion from year to year. The remaining value of the described trend function indicates the theoretical notional amounts outstanding of the examined CDS in the first year of the analysis. The observed decline in the notional amounts outstanding of CDS of non-financial institutions (since 2010) can be attributed to regulatory changes introduced in 2010 on the European market (Regulations of the European Parliament and of the Council, No. 648/2012) and on the American market (Wall Street Reform and Consumer Protection Act). The fundamental change in the current functioning of the CDS market was the establishment of central counterparties (CCPs) and the “trade repository.” CCP’s responsibility is based on the correct settlement of standardized CDS contracts. The ‘trade repository,’ on the other hand, is a legal person whose task is to collect and store data on derivatives at the central level.

Additionally, the European Securities and Markets Authority (ESMA) was established on the European market. Its task is to centrally supervise the OTC derivatives market, conduct a CCP licensing policy and determine the types of instruments that require clearing in the CCP. The introduction of new regulations was aimed at increasing market security and transparency and expanding control over market participant transactions. However, research shows that the introduction of the regulatory changes has led to a decrease in CDS nominal value concluded by non-financial institutions. The results of the study are consistent with the results observed in earlier studies concerning the total CDS market and suggest that CDS is a niche market (Czech, 2019a).

On the CDS market, non-financial institutions occur on both the buyers and sellers side of CDS contracts (Figure 1.9).

The purchase of CDS contracts protects non-financial institutions from the insolvency of the debtor, related to both for holding debt securities in their investment portfolios and for granting mercantile credits (deferring payment). The average notional amounts outstanding of CDS contracts purchased by these institutions was just over USD 280 billion. By purchasing a CDS contract, non-financial institutions transfer credit risk and obtain a guarantee of recovering the secured value of the underlying assets. The advantage of this transaction is maintaining its own creditworthiness and maintaining positive relationships with business counterparties whose liabilities are secured.

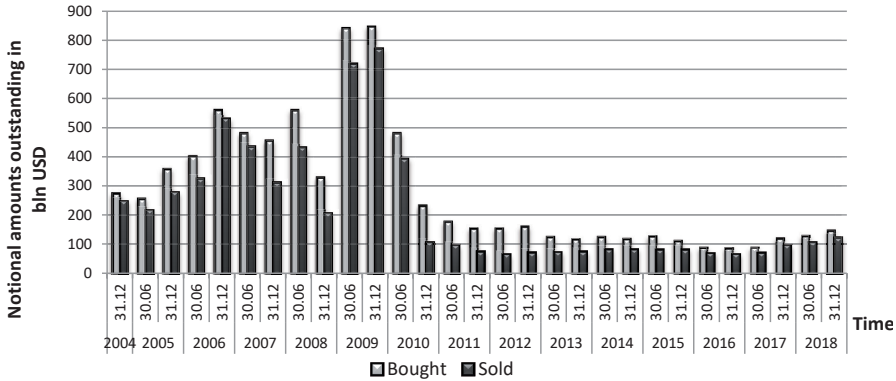


Figure 1.9. Notional amounts outstanding of non-financial institution CDS of purchased and sold transaction

Source: Based on BIS, OTC derivatives statistics, 2004–2018.

On the other hand, the sale of CDS contracts by non-financial institutions allows the assumption of credit risk and participation in profits on the credit market. Non-financial institutions were willing to take over the credit risk of other entities at the beginning of the examined period, as indicated by the notional amounts outstanding of sold CDS contracts. The average notional amounts outstanding of CDS contracts sold by non-financial institutions were USD 216.24 billion. In the event that the debtor, whose liabilities are hedged, discontinues servicing their obligations, non-financial institutions act as guarantors of cash payments to entities that have hedged against credit risk. In return for providing guarantees, non-financial institutions receive a premium and thus diversify their sources of income. Regulatory changes that have covered the CDS market are not the only factor affecting the decrease in the notional amounts outstanding of CDS contracts concluded by non-financial institutions. The results of previous CDS market research show that this market is also affected by the level of debt (Czech, 2019a). It is therefore assumed that there is a correlative relationship between the notional amounts outstanding of CDS contracts concluded by non-financial institutions and the level of global debt. In this study, it was assumed that the factors reflecting the level of global debt are the following indicators:

- total credit to households ratio;
- total credit to non-financial corporations ratio;
- total credit to the government sector at nominal value ratio;
- bank credit to the private non-financial sector ratio.

The first three indicators reflect the total indebtedness of households, non-financial enterprises, and government debt (in relation to GDP) towards all creditors (domestic banks, other national financial institutions, non-financial enterprises, and non-residents). Whereas the last – fourth indicator covers only loans granted by domestic banks to the total private non-financial sector (including households, non-financial enterprises, and the government sector). All of these ratios are significant in terms of credit risk. Excessive indebtedness of households and enterprises may threaten the financial security of countries and entire regions. For example, one of the reasons for the bankruptcy of Lehman Brothers was the excessive household debt in the United States (subprime loans). It was therefore considered that these factors should be examined for their impact on the nominal value of CDS contracts concluded by non-financial institutions.

The results of the multiple linear regression analysis indicate that the notional amounts outstanding of CDS contracts concluded by non-financial institutions correlates with the total credit to households ratio and the bank credit to the private non-financial sector ratio. The other two indicators – the total credit to non-financial corporations ratio and the total credit to the government sector at nominal value ratio proved to be statistically insignificant (Table 1.8).

Table 1.8. Multiple linear regression analysis results. Impact of debt ratios on the notional amounts outstanding of CDS contracts concluded by non-financial institutions

Dependent variable	The notional amounts outstanding of CDS contracts concluded by non-financial institutions	
Parameters for independent variables	Total credit to households ratio	153.93
	Bank credit to the private non-financial sector ratio	-82.18
	Total credit to the government sector at nominal value ratio	Statistical insignificant indicator
	Total credit to non-financial corporations ratio	Statistical insignificant indicator
Multiple Regression Correlation Coefficients	The R_c determination coefficient	0.79
	Estimation error	189.00
	The statistical value of F-test	27,747
	Probability value $p < 0.00000$	0.00000

Source: Based on BIS, OTC derivatives statistics, 2004–2018.

The results of the multiple linear regression analysis were divided into three parts. The first part (first row) presents the dependent variable – the CDS nominal value of non-financial institutions. In the second part (rows 2–5), indicators influencing the nominal value of the examined CDS contracts are

presented – independent variables and parameters for independent variables, obtained in the course of the analysis. The third part (lines 6–9) presents the results of the assessment of the significance of the parameters of the multiple linear regression model. The values of R², which is 79.25%, showed a good agreement between the dependent and independent variables for the regression.

The estimation error (189.00) indicates the average difference between the observed variable values and the theoretical values. The value of F statistics, at the probability level $p < 0.05$, significantly differed from zero, which indicated a good estimate of the model parameters and showed that the model was accurate in describing the statistical data.

The estimated multiple linear regression model is described by the equation:

$$\hat{Y} = -3984.25 + 153.93 x_1 - 82.18 x_2 \quad (6)$$

The dependence of the notional amounts outstanding on debt ratios can also be described in other words: $\hat{Y} = -3984.25 + 153.93 * \text{total credit to households ratio} - 82.18 * \text{bank credit to private non-financial sector ratio}$.

The results of the analysis show the importance of the total credit to households ratio (153.93). This result is justified both in history and economics. As history has shown, the excessive increase in household debt was one of the causes of financial crises in the past (Mian & Sufi, 2014; International Monetary Fund, 2012). On the other hand, loans drive the economy and affect economic growth. Loans make it possible to increase consumption and, consequently, to increase production and employment. The study of the impact of this indicator on the CDS contracts notional amounts outstanding concluded by non-financial institutions proves that the increase in household debt has a positive impact on the increase in the nominal value of CDS. This is also confirmed by the results of the analysis of the dynamics, where it was proved that non-financial institutions are more inclined to hedge against credit risk than taking over this risk. Excessively indebted households are forced to save more and reduce expenses in order to increase their debt servicing capabilities. Reducing expenditure by households has a direct impact on reducing demand and, consequently, on production decreasing and unemployment increasing. What originally constituted an advantage, and a premise for households' indebtedness, becomes a big disadvantage in the event of their excessive debt. This is how the market perceives it, as evidenced by the results of the study.

The key parameter affecting the CDS notional amounts outstanding of non-financial institutions is also the bank credit to the private non-financial sector ratio. This indicator shows the total loans granted by domestic banks

to the private non-financial sector in relation to GDP. Studies have shown that as the indebtedness of households, non-financial corporations and the total government sector increases, the notional amounts outstanding of CDS contracts concluded by non-financial institutions decrease (negative correlation). This results from the fact that, on the one hand, each type of foreign capital (loans, bonds) generates costs in the form of interest that companies have to pay to lenders and, on the other hand, influences the growth of investments and, consequently, the increase in efficiency of enterprises. The increase in the bank credit to the private non-financial sector ratio is caused by the excessive indebtedness of enterprises, resulting from the availability of cheap money. Since the financial crisis, the vast majority of countries have pursued an expansive monetary policy. This, in turn, enables enterprises to obtain cheap money and development, and consequently, a decrease in the CDS notional amounts outstanding. However, the risk related to corporate indebtedness should be taken into account. The change in monetary policy by monetary authorities, monetary tightening, and an increase in interest rates increase the cost of servicing corporate debt. In this case, there is a risk that companies are not able to cope with the higher cost of debt servicing and cease to service the debt. This situation also affects other enterprises with good financial condition. Ultimately, such a situation negatively impacts on credit risk, and the CDS notional amounts outstanding of non-financial institutions increase.

5. Conclusion

New challenges facing the modern financial market have forced the development of innovative forms of credit risk management not only in financial institutions but also in non-financial institutions. One of the basic credit risk management instruments useful in non-financial institution is the CDS contract. The conclusion of a transaction of purchase of a CDS contract by a non-financial institution gives an opportunity to hedge against the credit risk that is generated by debt instruments held in the investment portfolio or is the result of trade credits granted. On the other hand, concluding a transaction of sale of a CDS contract enables taking over the credit risk and participating in profits on the credit market. In this study, it has been proved that non-financial institutions are more active in the purchase transactions of the examined CDS contracts in comparison to their sale. It has also been shown that, due to regulatory changes, the activity of non-financial enterprises on the CDS market has decreased since 2010.

The main objective of the study was to determine the impact of global debt on the CDS contracts notional amounts outstanding concluded by non-

financial institutions. The results of the study confirmed that in the analyzed period the CDS notional amounts outstanding was changing under the influence of fluctuations in global household indebtedness and under the influence of total non-financial sector indebtedness in domestic banks.

The specific goal of this study was to bring the issue of CDS contracts closer to non-financial corporations and indicate the possibility of using these instruments in economic practice. Both the main and specific objectives have been met.

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Biographical note

Maria Czech (Ph.D.) is a research and didactic worker at the Department of Banking and Financial Markets at the University of Economics in Katowice. In her research, she focuses on issues related to the innovative methods of credit risk management and the extensive use of the credit default swaps in financial and non-financial institution. She conducts classes on financial innovation, banking, and financial markets.

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Spatial analysis of changes in the induced potential of the population as a measure of influence based on the example of the communes of the Opolskie Voivodeship in the year 2018

Katarzyna Widera¹

Abstract

The purpose of the study was to evaluate changes in the induced potential of the population and the income of the communes of the Opolskie Voivodeship in the year 2018 in comparison to the year 2000. The analysis made it possible to present the relationship between the ratio of the commune's own potential to induced potential and the influence of its surroundings (neighboring communes) on creating potential. In this way, the study determined the directions of the effect of spatial objects on the creation of categories of potential examined in the study. Statistical spatial analysis tools used in work included the spatial autocorrelation coefficient and the related global Moran's index, as well as Local Indicators for Spatial Association (LISA). The study also used the surface trend of the distribution of potential categories: population and income, and estimated its parameters and verified it statistically. Spatial analysis also revealed spatial diversity of the communes of the Opolskie Voivodeship in terms of the induced potential of the population and income. Another finding was the invariance of the ratio of own potential to induced potential as well as spatial distribution of the categories. The most important conclusions that can be drawn from the analyses determine the influence that the communes exert on their surroundings. Regional studies on the NUTS 5/LAU2 level constitute an important part of local analyses. The application of the potential theory, combined with tools of spatial statistics, offers a new perspective on the idea of the potential of the commune as a territorial unit. The study provides the basis for further regional analyses and may contribute to analyses of the development of local functional areas or growth poles in voivodeships. This article uses the physical potential theory in regional spatial research on the commune level in the Opolskie voivodeship. In addition, the

¹ Katarzyna Widera, Ph.D. Eng., Department of Economics and Management, Opole University of Technology, Luboszycka 7, 45-047 Opole, Poland, e-mail: k.widera@po.edu.pl (ORCID ID: 0000-0003-0651-8049).

analysis was enhanced by the use of spatial statistical analysis tools. The application of the physical potential theory in conjunction with the tools of spatial econometric analysis served to examine the role of the commune's surroundings in generating population potential and income potential.

Keywords: *population potential, income potential, induced potential, Moran's I, local indicators for spatial association, spatial analysis, trend surface*

1. Introduction

Potential as a research category is defined as a measure of mutual influence of spatial objects. When applying the physical potential theory to regional studies on any measurement level, the potential of an object (e.g., a commune) should be understood as the spatial availability of a specific territorial unit. Therefore, the assumption that spatial objects have a mutual influence on one another is the essence of the potential theory. Potential determines the intensity of interaction between objects (regions, voivodeships, poviats, or communes), taking into account e.g. economic quantities as well as distances between them. This study utilizes the following research categories based on the physical potential theory: population potential and income potential, which are considered spatial distribution functions of every population unit in a given area. The communes of the Opolskie Voivodeship are the population units (objects) examined in the present study.

Regional studies on level NUTS 5/LAU 2 constitute an essential part of local analyses. The use of the potential theory, coupled with the tools of spatial statistics, offers a new perspective on the idea of the potential of the commune as a territorial unit.

2. Literature background

An important aspect of regional studies conducted on any territorial level of administrative units (NUTS / LAU) is the attitude towards the units analyzed in the study, e.g. communes, poviats, voivodeships. The mutual nature of the influence of spatial units is determined by their location (Głowicka-Wołoszyn, 2016; Pietrzak, 2010a), and their interconnections have a significant effect on investigated phenomena (Klaassen, 1988).

Identifying the spatial association of those objects involves essentially the selection of a spatial weight matrix, which reveals the internal structure of interconnections between the objects (Łaskiewicz, 2014; Kuc, 2015; Pietrzak, 2010b). In this respect, mention should be given to studies by Kooijman (1976)

and Openshaw (1977), which focus on the values of Moran's I as a criterion of weight matrix selection. Meanwhile, Getis, and Altstadt (2010), based on Griffith's (1996) work, find that the adjacency matrix should result from geographical adjacency or simply the distance between the units in question.

When the weight matrix has been defined, the nature of spatial associations can be identified by global Moran's I (Sikora, 2009; Suchecki, 2010), a measure that determines the degree to which a phenomenon in a specific location is correlated with its values in other locations. If, from the perspective of a given study, we are interested in the local character of a phenomenon of interest, we must evaluate the degree of correlation of the phenomenon in the location and in adjacent locations (Anselin, 1995; Janc, 2006; Mastalerz-Kodzis, 2018a).

In the literature on the application of the physical potential theory in regional research (Czyż, 2002, 2011; Mastalerz-Kodzis, 2018b), such categories as population potential and income potential are discussed as spatial distributions of units of population over a specific area (Chojnicki, Czyż, & Ratajczak, 2011; Lewandowska-Gwarda & Antczak 2010).

Applications of the model of potential in regional studies include e.g. financial independence evaluation in publications by Głowicka-Wołoszyn and Wysocki (2014, 2015, 2016), local government's financial independence in a study by Surówka (2013). Müller-Fraćzek and Pietrzak (2009) assessed the economic potential of a selected voivodeship, while Mastalerz-Kodzis (2018b) measured the economic potential of the unit and the organization. Dong, Yang X, Cai, and Wang (2015) described the potential of an urban population in the Jiangsu province in China, and Klobučník, Málíková (2016) analyzed population potential in the Stredne Povazie region in the Slovak Republic. A study by Werner, Korcelli, and Kozubek (2014) describing changes in Poland's metropolitan areas using the potential theory is also worth mentioning.

3. Research approach and methods

In this study, 71 urban, rural, and urban-rural communes of the Opolskie Voivodeship were objects of spatial analysis. Distance between communes (objects) was defined as straight-line distance between towns where the seats of communes are located. Data concerning distances between the communes (objects) were retrieved from the Head Office of Land Surveying and Cartography (www.gugik.gov.pl). Statistical data on the communes were acquired from the Local Data Bank of the Central Statistical Office (www.stat.gov.pl). The data was analyzed in the Open GeoDa software by Luc Anselin as well as software Statistica PL 13.1.

A departure point for the analysis of spatial distribution of potential is the definition of research categories used in the study. The first category analyzed

is the population potential of a specific commune (object in space), given by the formula (1). The i -th commune's own population potential is the amount of its population. The sum in the formula (1) shows that the potential of a specific territorial unit is made up of its component potentials: the i -th object and all the remaining j -th spatial units (Müller-Frączek & Pietrzak 2009).

$$\text{Population potential of the } i\text{-th commune} = l_i + \sum_{j \neq i} \frac{l_j}{d_{ij}} \quad (1)$$

where:

l_i – the i -th commune's own population potential,

l_j – the j -th commune's population (from the surroundings of the i -th commune),

d_{ij} – distance between the i -th commune and the j -th commune.

The summands in the formula (1) express the i -th commune's own potential, i.e. the amount of its population, as well as the induced population potential. The second summand in the population potential equation is important in the light of the analysis of the effect of the commune's environment on the creation of this type of potential. Likewise, the income potential (Chojnicki et al., 2011) of a given commune is a measure of available income in the system of communes as spatial objects. It is defined as a function of income generated in the commune (object) and income in other communes (objects), taking into account the distance between them. Income potential of the i -th commune is given by the formula (2).

$$\text{Income potential of the } i\text{-th commune} = w_i + \sum_{j \neq i} \frac{w_j}{d_{ij}} \quad (2)$$

where:

w_i – i -th object's own income,

w_j – j -th object's own income (from the surroundings of the i -th object),

d_{ij} – distance between the i -th and the j -th object.

By analogy to the sum in (1), sums in the formula (2) express the i -th commune's own potential, that is its own income and its induced income potential. The category which expresses the direction of mutual influence in the spatial system of communes (objects) will be the ratio of own potential to induced potential given by the formula (3).

$$\text{Ratio of the } i\text{-th commune's own to induced potential} = \frac{w_i}{\sum_{j \neq i} \frac{w_j}{d_{ij}}} \quad (3)$$

If the value is more than 1, it means that the commune's environment plays a lesser role in creating its population potential and, likewise, its income potential.

The formula (4) is the departure point in the estimation of parameters of the spatial trend for the analyzed categories of induced potentials:

$$f(X, Y) = a_0 + a_1 \cdot X + a_2 \cdot Y + a_3 \cdot X \cdot Y + a_4 \cdot X^2 + a_5 \cdot Y^2 + a_6 \cdot X^2 \cdot Y + a_7 \cdot X \cdot Y^2 + a_8 \cdot X^3 + a_9 \cdot Y^3 + e \quad (4)$$

where:

a_i – structural parameters in the equation for $i = 0, 1, \dots, 9$,

(X, Y) – coordinates of the object (commune),

e spatial residual vector.

An integral part of tools used in the present study to evaluate the influence of the analyzed categories includes the spatial autocorrelation coefficient and its related statistics. The spatial autocorrelation coefficient describes the nature of the structure of the analyzed objects (Sikora, 2009). The statistical significance, or lack thereof, of the coefficient, provides information on the nature of the spatial relationship between the analyzed objects. For a statistically significant positive autocorrelation, we notice that objects tend to group in a space; if the autocorrelation is negative – we observe their dispersion. Global Moran's reveals the degree of the variable's correlation in a specific location with values of the variable in other locations (Sucheck, 2010) expressed by the formula (5):

$$I = \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (5)$$

where:

n – number of communes,

x_i, x_j – value of the analyzed category of potential in communes in locations,

\bar{x} – mean value of the analyzed potential category,

w_{ij} – weight matrix element determined on the basis of the commune's coordinates, which were used to calculate the distance between them.

Selection of the weight matrix can be defined on the basis of the adjacency criterion (Głowicka-Wołoszyn et al., 2017, Kopczevska, 2006) or e.g. Euclid

distance. LISA, i.e. Local Indicators of Spatial Association (Suchecki, 2010; Anselin 1995), is used to investigate local diversification of objects (communes). A local indicator of spatial association determines the similarity of the unit (commune) to its neighbors (other communes) and enables statistical evaluation of the significance of such a relationship. The procedure is used to identify: hot spots (HH) – objects with a high value of a specific variable surrounded by objects with a high value of the same variable; cold spots (LL) – objects with a low value of the variable surrounded by objects of an equally low value of the variable; outliers (LH) or (HL) – objects with a low value of the variable surrounded by objects of a high value of the variable or vice versa; and ‘not significant’ – objects with a statistically insignificant relationship to other objects. The study assumed a significance level of $\alpha = 0,05$.

4. Results and discussion

The analysis focuses on the spatial distribution of induced population potential and induced income potential. Both quantities play an important role in the assessment of the nature of the effect of the commune on the creation of population and income potentials. To this end, induced population potential spatial trend parameters were estimated for data for the year 2018 (Figure 1.10).

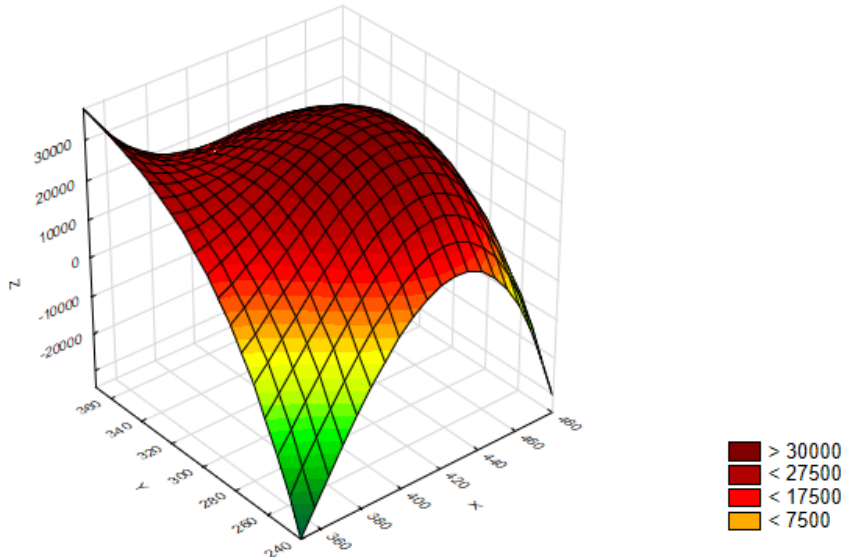


Figure 1.10. Spatial trend of induced population potential in 2018

Source: Author's own work in Statistica PL software v. 13.1.

The spatial trend model equation for induced population potential is given by the formula (6):

$$f(X, Y) = -3268770,216 + 27443,161 \cdot Y + 35,029 \cdot X^2 - 80,139 \cdot X \cdot Y - 29,570 \cdot Y^2 + 0,094 \cdot X^2 \cdot Y - 0,055 \cdot X^3 + 0,027 \cdot Y^3 + e \quad (6)$$

Table 1.9 contains the verification of the statistical significance of induced population potential spatial trend parameters in 2018, while Table 1.10 and Figure 1.11 present the assessment of the conformity of the model's residuals with normal distribution.

Table 1.9. Results of the estimation of the spatial trend of population potential

parameter	rating	S(a _i)	t-statistic	p-value
a ₀	-3268770.216	708466.373	-4.614	0.0000
a ₂	27443.161	6714.207	4.087	0.0001
a ₃	35.030	9.200	3.807	0.0003
a ₄	-80.140	24.358	-3.290	0.0016
a ₅	-29.570	10.409	-2.841	0.0061
a ₆	0.094	0.029	3.282	0.0017
a ₈	-0.055	0.014	-3.799	0.0003
a ₉	0.027	0.011	2.383	0.0202

Source: Author's own calculations made using Statistica PL software v. 13.1.

Table 1.10. Test results X^2

X^2_d	p-value
7.71817	0.17247 > 0.05

Source: Author's own calculations made using Statistica PL software v. 13.1.

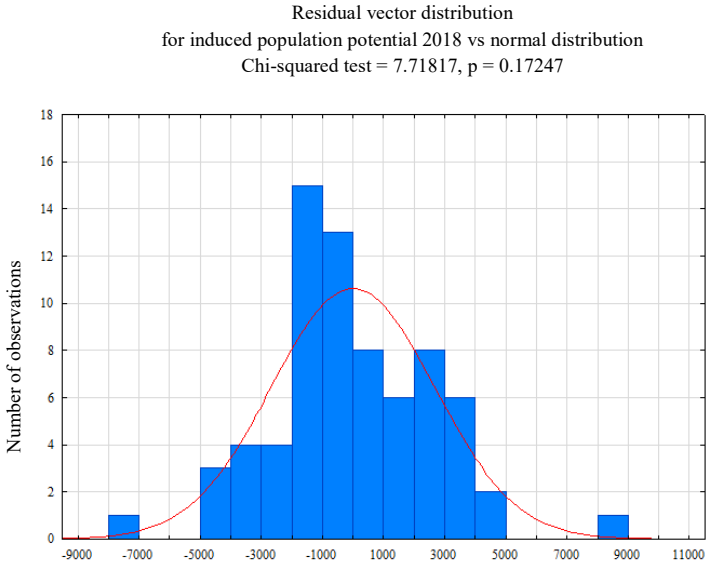


Figure 1.11. Distribution of the residuals of the spatial trend model of induced population potential in 2018

Source: Author’s own work in Statistica PL software v. 13.1.

All induced population potential spatial trend parameters are statistically significant, and the distribution of residuals conforms to normal distribution. In the next step, parameters of the spatial trend of induced income potential from 2018 were estimated. The equation of the model is given by the formula (7):

$$f(X, Y) = -6628348651,674 + 51351933,935 \cdot Y + 90412,190 \cdot X \cdot Y + 202426,175 \cdot X^2 - 13789,285 \cdot Y^2 + 238,220 \cdot X^2 \cdot Y - 141,701 \cdot X^3 + e \quad (7)$$

Table 1.11 contains the verification of statistical significance of induced income potential spatial trend parameters in 2018, while Table 1.12 and Figure 1.13 present the assessment of the conformity of the model’s residuals with normal distribution.

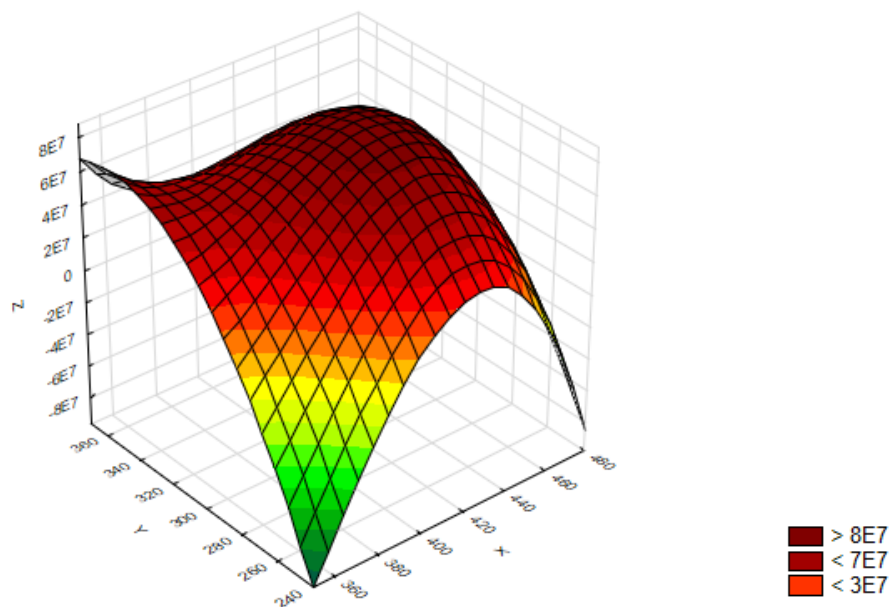


Figure 1.12. Spatial trend of induced income potential in 2018

Source: Author's own work in Statistica PL software v. 13.1.

Table 1.11. Results of the estimation of the spatial trend of induced potential of income

parameter	rating	S(a _i)	t-statistic	p-value
a ₀	-6628348651.674	1982494543.071	-3.343	0.0014
a ₂	51351933.935	18438475.426	2.785	0.0070
a ₃	90412.190	32314.327	2.798	0.0068
a ₄	-202426.175	85652.504	-2.363	0.0212
a ₅	-13789.285	1403.061	-9.828	0.0000
a ₆	238.220	100.885	2.361	0.0213
a ₈	-141.701	50.695	-2.795	0.0068

Source: Author's own calculations made using Statistica PL software v. 13.1.

Table 1.12. Test results X^2

X^2_d	p-value
4.99247	0.17235 > 0.05

Source: Author's own calculations made using Statistica PL software v. 13.1.

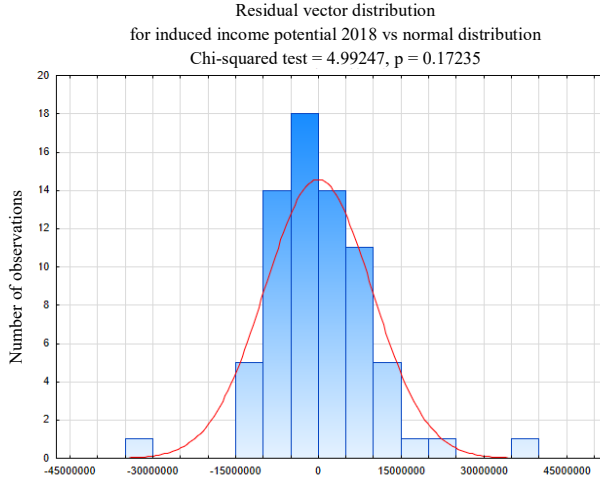


Figure 1.13. Distribution of the residuals of the spatial trend model of induced income potential in 2018

Source: Author’s own work in Statistica PL software v. 13.1.

All induced income potential spatial trend parameters are also statistically significant, and the distribution of residuals conforms to normal distribution. Figures 1.14 and 1.15 compare the indicators of spatial autocorrelation and their global Moran’s statistic for the analyzed categories of induced potentials in the years 2000 and 2018.

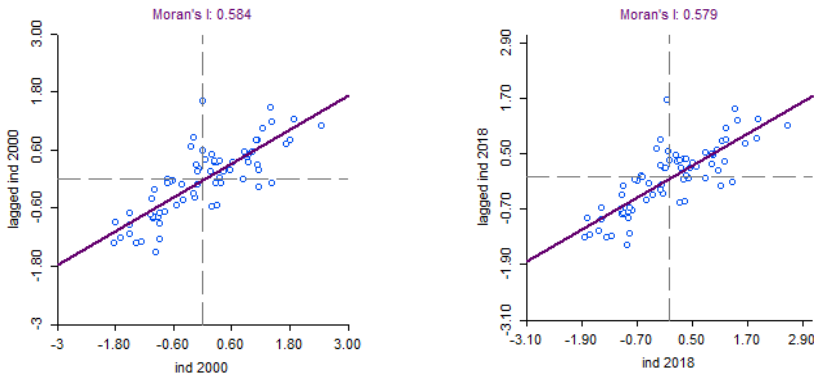


Figure 1.14. Dispersion of empirical points for the calculation of the coefficient of spatial autocorrelation for induced population potential in the years 2000 and 2018

Source: Author’s own work in Open GeoDa software.

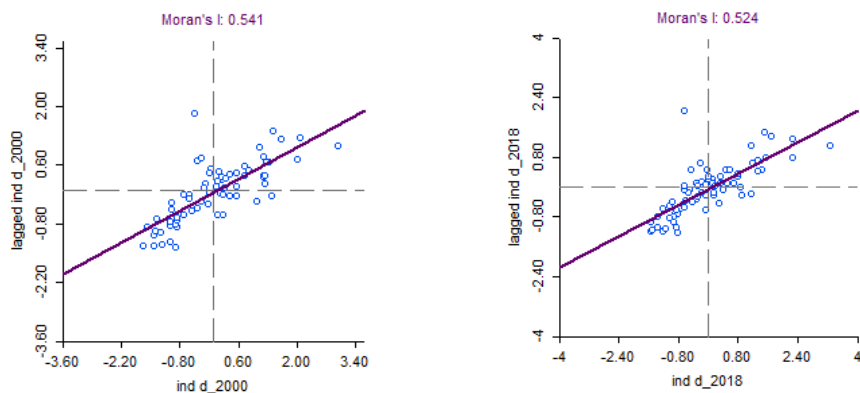


Figure 1.15. Dispersion of empirical points for the calculation of the coefficient of spatial autocorrelation for induced income potential in the years 2000 and 2018

Source: Author's own work in Open GeoDa software.

Statistically significant changes in the values of autocorrelation coefficients for induced potentials for 2000 and 2018 would imply, if the coefficient grew, the convergence of communes of a similar level of induced potential. If the value of the coefficient fell, those communes (objects in a space) would be divergent. A conclusion that could be drawn from Figures 1.14 and 1.15 is that between 2000 and 2018, there was no change in the spatial distribution of the categories.

Table 1.13. Moran's I values and their verification

Variable	Moran's statistic (I)	Z(I)	p-value
Induced population potential 2000	0.5840	7.2301	< 0.05
Induced population potential 2018	0.5408	6.7134	< 0.05
Induced income potential 2000	0.5786	7.1837	< 0.05
Induced income potential 2018	0.5243	6.6057	< 0.05

Source: Author's own work in Open GeoDa software.

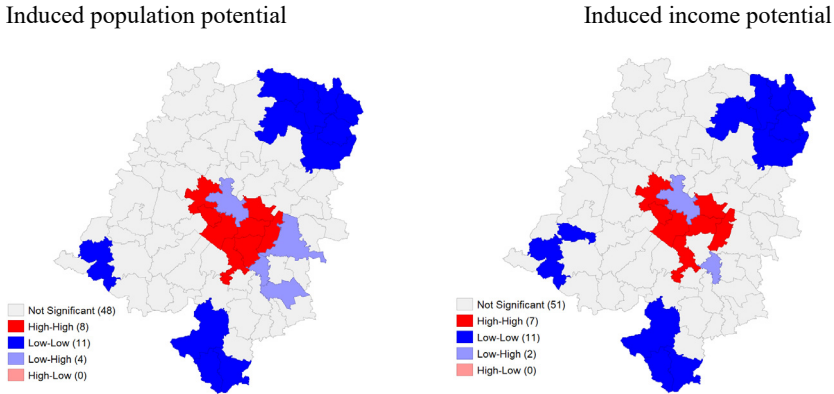


Figure 1.16. Spatial similarity of communes for induced potentials

Source: Author’s own work in Open GeoDa software.

Local Moran values in the analysis of induced population potential were statistically significant for 23 communes. Four communes (“Low-High”) have low induced population potential and are adjacent to communes with a high level in this category. Eight communes (“High-High”) that have a low level of potential are surrounded by neighbors with a high level of potential. Eleven communes (“Low-Low”) with a low level of potential and surrounding communes also have the same level in this category. At the same time, local Moran values in the analysis of induced income potential were statistically significant for 20 communes; the distribution of communes is similar to the one observed for induced potential of population. Two communes (“Low-High”) have a low induced income potential and are adjacent to communes with a high level in this category. Seven communes (“High-High”) that have a low level of potential are surrounded by neighbors with a high level of potential. Eleven communes (“Low-Low”) with a low level of potential and surrounding communes also have the same level in this category.

Tables 1.14 and 1.15 contain descriptive statistics of the ratio of own potential to induced potential of the analyzed categories.

Table 1.14. Descriptive characteristics of the ratio of own to induced population potential

Years	mean	median	min	max	lower quartile	upper quartile	st.dev.
2000	0.538	0.280	0.123	4.319	0.211	0.602	0.660
2018	0.539	0.280	0.119	4.643	0.214	0.604	0.689

Source: Author’s own work in Statistica PL software v. 13.1.

Table 1.15. Descriptive characteristics of the ratio of own to induced income potential

Years	mean	median	min	max	lower quartile	upper quartile	st.dev.
2000	0.543	0.210	0.061	7.974	0.127	0.516	1.063
2018	0.556	0.204	0.059	10.354	0.134	0.475	1.292

Source: Author’s own work in Statistica PL software v. 13.1.

Statistical analysis of the quantities indicates a high concentration below the mean value. The median value in those distributions is below the mean, which suggests a clear right-hand asymmetry. This implies that in most analyzed communes the ratio of own to induced population potential, as well as own to induced income potential, is less than 1.

An assessment of the mutual influence of spatial objects (communes) involves determining the ratio of own potential to induced potential. Here, influence is understood as a real impact on creating specific potential for individual objects (communes). The proportion of this value to 1 enables us to capture the direction of the influence between the objects (communes). Figure 1.17 presents the dispersion of empirical points of the relationship between the ratio of own to induced population potential and the ratio of own to induced income potential in 2000 and 2018. In the case of a small number of communes we may find that the ratio is smaller than 1.

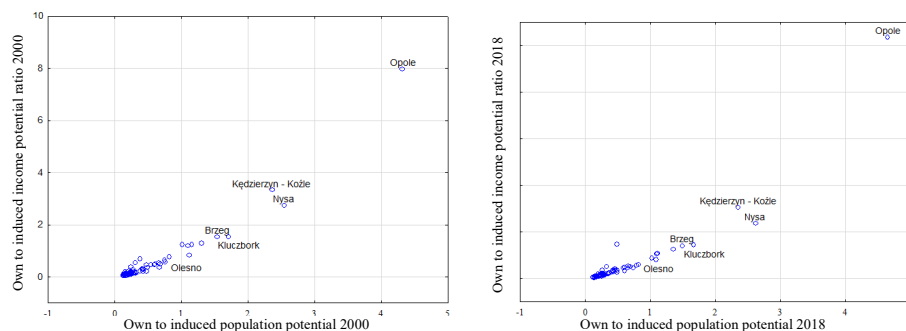


Figure 1.17. Dispersion of empirical points of the relationship between the ratio of own to induced population potential and the ratio of own to induced income potential in 2000 and 2018

Source: Author’s own work in Statistica PL software v. 13.1.

5. Conclusion

An assessment of changes in induced population and income potential of the communes of the Opolskie Voivodeship in 2018, in comparison to 2000, did not reveal statistically significant changes in the investigated categories. An analysis of the relationship between the ratio of the commune's own potential to induced potential, and the effect of its environment (neighboring communes) on creating its potential, revealed that the relationship did not vary over the analyzed period. In most communes that displayed a ratio of potentials below 1 (i.e., the environment which had a greater impact on creating their potential than such communes themselves), such a relationship did not change.

The use of spatial analysis tools enabled an assessment of the spatial similarity of the analyzed categories, but also revealed an absence of statistically significant differences in the spatial distribution of communes with a similar level of investigated categories. The application of the potential theory, combined with tools of spatial statistics in regional research on a local level, offered a new perspective on the idea of the potential of the commune as a territorial unit. This provides the basis for further regional studies and may contribute to analyses of local functional areas or growth poles in voivodeships.

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Biographical note

Katarzyna Widera (Ph.D. Eng.) is a member of the research and teaching staff at the Department of Economics, Finance and Regional Research at the Faculty of Economic and Management of the Opole University of Technology. She teaches classes on descriptive statistics, statistical inference, econometrics as well as forecasting and simulation. In her scientific work, she deals with the application of quantitative methods in regional management, e.g. methodological aspects of measuring regional evaluation. She analyzes socio-economic phenomena using tools applied in statistics and econometrics. Her recent research includes analysis of regional development for local functional areas and communes in the Opolskie Voivodeship and in Poland.

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Chapter 2.
Management and business challenges

Improving business processes and process organization from the Industry 4.0 perspective

Natalia R. Potoczek¹

Abstract

The aim of the article is to recognize the popularity and dynamics of research on improving business processes and process organization in enterprises, institutions, and other organizations. Bibliometric research was conducted to identify research gaps and developing research areas. The research used the resources of the Web of Science Core Collection database. As a result of the research, it was found that the popularity and dynamics of research work in the field of process improvement are emerging. Research to date conducted in the field of measuring performance mainly refers to functionally oriented organizations. The often-postulated direction of a comprehensive approach to process improvement and process orientation of the organization is still not gaining significant interest among researchers, as indicated by the number of publications. The conducted analyses showed an increase in interest in process issues in management and business sciences with the dominant activity of researchers representing IT disciplines. The majority share of IT environments in research on process improvement indicates the dominant role of digital technologies in Business Process Management, which seems understandable in the era of Industry 4.0. The growing share of researchers in management sciences is a positive symptom. However, the share of research devoted to process organizations creating favorable conditions for the digital transformation of processes may still be insufficient or even inhibitory.

Keywords: *Business Process Management (BPM), Business Process Improvement (BPI), Process Orientation (PO), Industry 4.0, digital technologies, bibliometry.*

¹ Natalia R. Potoczek, Ph.D., Hab., Professor of the Institute of Economics, Polish Academy of Sciences, Nowy Świat 72, 30-330 Warsaw, Poland, email: npotoczek@inepan.waw.pl (ORCID ID: 0000-0002-7288-0321).

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1. Introduction

The real premise for researching business should be the real need for an organization. Improving the organization and processes occurring in them is an activity that an economic entity takes to enhance financial results or other non-financial results, primarily if the entity conducts non-profit activities. In each case, the most motivating factor for improvement is the pressure from customers or recipients of products and services. Therefore, taking into account the growing competition on the goods and services market, the obvious consequence is the need for continuous improvement of the organization and processes that provide goods to external and internal customers of enterprises, institutions, and other organizations. The importance and dynamics of research on process improvement and the development of process orientation in organizations have become the main focus of this article.

The primary goal of the article is to identify research activity in the field of improving business processes and developing the process orientation of the organization, as well as to attempt to identify potential research areas or gaps. The analysis of research activity in this area will be carried out from the perspective of the developing Economy 4.0. The contemporary Business Process Management (BPM) trend was initiated in the IT environment at the end of the 20th century in connection with the developing technology and the offer of software supporting management processes in enterprises and production automation. Currently, enterprises are increasingly using the support offered by the latest Industry 4.0 technologies such as Big Data, Internet of Things, Internet of Services, Cloud Computing, and Smart Manufacturing. Questions at this stage of the ongoing research program relate primarily to the popularity and dynamics of research in the field of improving business processes and process-oriented organizations. In profiling research areas, reference was made mostly to the demand and dynamics of the Business Process Management approach, improving business processes, measuring process performance, and testing the organization's process orientation. Adopting the Economy 4.0 perspective allows additional identification of developing research areas, for example, through the participation of research communities and the importance of digital technologies in process improvement. The research was based on the resources of the Web of Science (WoS) database, grouped in the Core Collection package. Details of the research process are presented in the methodical part of the paper.

2. Theoretical foundations of developing process orientation and improving business processes

2.1. Business Process Orientation research perspective

Enterprises under constant competitive pressure are forced to verify their business models with particular emphasis on processes. Business processes² create a kind of bloodstream for the organization's functioning. The activity of an enterprise or institution is carried out primarily as part of processes, and products or services are the results of processes. In other words, business management means managing its processes (McCormack & Johnson, 2001). According to Elzing et al. (1995), BPM refers to a systematic, structured approach to analyzing, improving, controlling, and managing processes to improve the quality of products and services. Zairi (1997) describes BPM as a structured approach to the analysis and continuous improvement of basic activities such as marketing, production, communication, and other important elements of the company's activity. BPM relies on measurements made to assess the performance of each individual process, set goals, and provide baselines that can meet corporate goals. Armistead and Machin (1998), Lee and Dale (1998) claim that BPM aims to adapt business processes to strategic goals and customer needs, but this requires a change in the company's focus from functional to process orientation. The authors claim that BPM solves many problems of the traditional hierarchical structure because it focuses on the client, integrates functional areas in processes, and employees participate in the final results of processes, and not only the organizational cells to which they belong.

Extensive literature and numerous studies conducted over the past three decades suggest that organizations can improve their performance through process-oriented behavior. Moreover, the more the organization is oriented on the business process, the better it works both from the employees' perspective and from the overall perspective of the organization. The functional approach creates barriers to achieving customer satisfaction, which is why for many years companies have been trying to orientate towards processes. To maintain market competitiveness, it is assumed that companies should implement Business Process Orientation (BPO). Process orientation is expressed in the following assumptions:

- business processes play a strategic role in creating value;
- processes should be constantly improved;

² At the core of BPM development lies the precise definition of a business process. Therefore, the process is treated as a coordinated chain of actions aimed at obtaining a business result or a repetitive cycle that achieves a business goal (Pourshahid, 2008). The process recognizes an economic mechanism that transforms resources into measurable results. There are four key features of each process (Zairi, 1997): 1) predictable and definable input; 2) linear and logical sequence or flow; 3) a set of clearly defined tasks or activities; 4) predictable and desired results.

- the organization is strongly customer-oriented;
- process owners are defined and responsible for the success of the processes;
- the organizational structure is consistent with the main processes;
- process performance is measured and monitored.

Interest in processes at the end of the twentieth century led researchers to believe that transforming a company into a process-oriented organization would determine the competitive advantage of the enterprise (Davenport, 1993; Hammer & Champy, 1993; Burlton, 2001; McCormack & Johnson, 2001; Skrinjar et al., 2008). It was expected that process-oriented organizations would have a higher level of adaptability to market changes, provide high-quality products faster, and demonstrate a greater degree of response to customer needs (Hammer & Champy, 1993; Braganza & Bytheway, 1997). However, most organizations are still functionally oriented and employees exhibit functional-oriented behavioral responsibilities. Employees must adopt process-oriented thinking to realize the benefits described. Meanwhile, compared to a function-oriented organization, process-orientation is an inter-functional and customer-oriented way of thinking and working (McCormack, 2001). Employees can still work in their departments, but they should know the tasks and their configuration as part of the processes in which they participate. They should coordinate their work with other employees in the processes and show interest in the cooperation and work of other employees. Process orientation requires employees to have cognitive skills, knowledge of tasks, and a willingness to change (e.g. internal and external motivation; Tang et al., 2013) and strive to cooperate in improving integrated processes (Kumar et al., 2010; Tang et al., 2013).

After over two decades of BPM and BPO implementations, given that the first research in this field was published in the nineties of the twentieth century, reorienting an organization from functional to process is still a challenge. The latest publications confirm this stance, e.g., Novak & Janeš (2019) researched 19 enterprises in the Slovenian energy industry to determine the level of BPO maturity. Surveys conducted among the top, middle, and lower-level managers. A questionnaire for the extended concept of process orientation was used as the measuring instrument. BPO measurement results show that despite such long-term interest in processes, certified management systems, and computerization of operations, the maturity of processes is not high.

Over the past two decades, researchers have referred to various symptoms when defining process orientation, many of which have been confirmed in subsequent studies. McCormack and Johnson (2001) pointed out that a process-oriented organization emphasizes processes as opposed to hierarchies with a particular focus on results and customer satisfaction. Similar assumptions in their research on process orientation were introduced ten years later by

Kohlbacher and Gruenwald (2011), stating that Process Orientation means focusing on business processes and not emphasizing the functional structure or hierarchy. As a result of the conducted research, they found that PO is a structure consisting of many dimensions, which include:

- design and documentation of business processes;
- management's commitment to BPO;
- the role of the process owner;
- process efficiency measurement;
- corporate culture consistent with the process approach;
- use of continuous process improvement methods;
- a process-oriented organizational structure.

Similar research results including improved response to market behavior, customer satisfaction, cost reduction, and quality improvement as well as other benefits were pointed out by Movahedi and Miri-Lavassani (2016) in empirical research on the intra- and inter-organizational orientation of business processes in 3200 profit-oriented organizations.

Process orientation is also treated as the ability to transform input data as raw materials and information into output data as products and services. The process itself, in which many roles in the organization work together to transform input into output products, has been described under various names, including workflow, work process, and business process. The main challenge for organizations seeking to improve processes was their implementation in the organization (Skrinjar & Trkman, 2013), including total quality management, continuous improvement of services, or reengineering of business processes (BPR). Many researchers have emphasized that the Business Process Management approach in a complementary way describes how management involves different principles in the process of process improvement (Armistead and Machin, 1998; Lee and Dale, 1998). According to this belief, if BPM is recognized in the enterprise as the primary management method, it means that the organization is process-oriented.

Although the popularity of the issues of process orientation is not as impressive as the focus on processes themselves, it is still present in the literature using various categorizations. Process orientation can be considered at the level of the entire company as well as an individual employee who is the executor of the process. Research works by Hellstron and Eriksson (2008), Kumar et al. (2010), Kohlbacher and Gruenwald (2011), or Kohlbacher and Reijers (2013) are focused on measuring orientation at the level of the entire organization of the company in comparison with its overall performance. Recent work (e.g., Christiansson & Rentzhog, 2020; Dobrosavljević et al., 2020; Lederer et al., 2020) shows that this direction of thinking is present in companies. However, the presented research is most often based on individual

cases, e.g., Christiansson and Rentzhog (2020) drew attention to the poor development of process orientation in organizations, presented the case of a Swedish public housing cooperative and on its example the importance of strategy for BPO, which can facilitate the reorientation of management in the organization according to processes. Dobrosavljević et al. (2020) conducted a study on the levels of process maturity in enterprises (SMEs) of the clothing industry. It has been assumed that process orientation can have a different impact on a company's success. The results of the research led the authors to the conclusion that the priority dimension refers to man, which in consequence should lead to increased commitment to building process orientation of all employees. Contemporary publications also provide proposals for model solutions, e.g., Lederer et al. (2020) draw attention to the inter-functional nature of processes. Business processes usually run in many departments, creating organizational interfaces that often cause errors and thus weaken the organization. The interface criticality assessment model proposed by the authors and the IT prototype are intended to support the enterprise in developing process orientation (e.g., by building a common language or creating dedicated human resource management systems).

Process orientation studied at the individual level results from the assumption that individual process-oriented employee behavior is a key success factor for an organization that implements process orientation in various dimensions at the company-wide level. Employees should perform tasks coordinated with the tasks of colleagues, following their competences and personal responsibility. The same continuous process improvement should take place in cooperation with all process participants (Forsberg et al., 1999). At the same time, it is assumed that process orientation must be a shared value that is understood and implemented by all employees in the organization (Hellstrom and Eriksson, 2008; Chen et al., 2009). More, recent work is already focusing on solutions that will consolidate proper behavior in the long term, e.g., Leyer et al. (2018) tackled the issue of preserving behavioral changes in terms of process orientation in everyday practices. The effectiveness of the learning method of role-playing was analyzed in detail. The results obtained were considered as promising and worth recommending methods in a managerial environment.

2.2. Economic and social context of Business Process Improvement

Each organization should monitor and measure the results of its processes and analyze its results for improvement. Performance is defined as the achievement of a given task measured against established known standards of accuracy, completeness, cost, and time (Bierbusse & Siesfeld, 1997).

Performance measurement is a complex issue that usually involves at least four disciplines: economics, management, accounting, and information technologies (Tagen, 2004). Performance Measurement Systems (PMS) have been at the forefront of the research and business program over the past few decades. Companies have realized the importance of PMS as a tool that would enable them to grow (Najmi, Fan, & Rigas, 2005). It is now widely accepted that the use of adequately defined measures can ensure the strategic adaptation of an organization to a changing environment. Companies are at various stages of implementing and improving their performance measurement systems and find solutions for many practical and conceptual challenges. There are several factors to consider when designing and implementing the right PMS for a particular organization. Robson (2004) stated that before attempting to identify all possible factors, it is essential to understand that the main reason for implementing PMS is to provide the most significant opportunity to increase the overall efficiency of business processes. In this case, the measurable subjects of research are business processes, because they form the core of the organization's operation, given that the organization consists primarily of processes, not products or services. That is why modern companies adopt process orientation, abandoning the functional perspective.

Understanding performance measurement in both economic and social terms is critical. Measurements have become an accepted approach in organizations. Significant effort is devoted to identifying what can be measured and how to measure it. However, the question of why something should be measured is still too rarely asked. This last question has both an economic and social dimension. Each measurement operation involves both implementation and maintenance costs. Any additional action (e.g., for measuring) potentially reduces process efficiency. Without knowing the exact circumstances in which a measurement system will improve or not improve performance, it is difficult to justify the additional costs of implementing a measurement system (Robson, 2004).

Performance measurement can be defined as a process for the quantification of performance and efficiency (Neely, Gregory, & Platts, 2005). The measurement function consists in developing a method of generating a class of information that will be useful in many different problem situations. Unfortunately, as many researchers note (e.g., Sidrova & Isik, 2010), performance measurement is a complex, frustrating and challenging puzzle, at the same time demanding, critical, and unfortunately, often abused. Research on the efficiency of processes at the initial stage of the BPM approach was carried out about the effectiveness of the entire organization. Performance Measurement System has been present in the literature since the beginning of the 90s, mainly in the field of management, accounting, and operations management. Neely et al. (1995) defined PMS as a set of indicators used to

quantify both efficiency and effectiveness of operations. PMS, according to Kueng et al. (2001), performs the following functions:

- tracks the performance of the organization;
- supports the company's internal and external communication regarding results;
- helps managers by supporting both tactical and strategic decisions;
- captures knowledge within the company and facilitates organizational learning.

Tatitcchi, Tonelli, and Cagnazzo (2010) identified the detailed identification and classification of performance testing models. They noted that the growing interest in production processes since the mid-1980s translated into the development of performance measurement models. After years of popularity of models based on indicators such as Return on Investment (ROI), Return on Equity (ROE), Return on Capital Employed (ROCE) with derivatives (Simons, 2000), Economic Value Added (EVA) (Stewart, 2007), Activity-Based Costing (ABC) and Activity-Based Management (ABM) (Cooper & Kaplan, 1988) the Balanced Scorecard published in 1992 by Kaplan and Norton (1992) received undoubtedly the most significant interest, and in the following years also in the Harvard Business Review detailed and disseminated by the authors themselves (Kaplan & Norton, 1993; 1996).

The methods used to measure performance were focused on measuring performance throughout the organization and, therefore, did not provide detailed information relevant to individual processes and the possibilities of improving them. The process performance measurement system was inspired as a consequence of the perceived needs in managerial practice and the creation of opportunities for individual groups of employees to focus on the processes in which they participate. A new Process Performance Measurement System (PPMS) model has been proposed. Kueng (2000) characterized PPMS as an information system that:

- collects data on the performance of one or several business processes using a set of indicators;
- compares current values with historical and target values;
- disseminates the results (present value, target value, gap, and trend for each selected indicator) to process participants.

The main goal of PPMS is to provide comprehensive and current information on the efficiency of business processes. This information can be used to communicate the goals and ongoing performance of the business process directly to the process team. In addition, it can be used to improve resource allocation and process efficiency, to give early warning signals, diagnose weaknesses in the business process, decide whether corrective actions are necessary, and assess the impact of actions taken (Kueng, 2000).

According to Kueng (2000), PPMS does not focus only on measuring quality, time, costs, or flexibility, but also on business process stakeholders. Each process should have an identified stakeholder group. In addition to employees who are contractors of the process, the stakeholders can include recipients (external and internal customers), suppliers, investors, lenders, etc. For each stakeholder or group of stakeholders, it is necessary to set process goals. Based on this assumption, it would be necessary to study process efficiency through the degree of stakeholder satisfaction (Kueng, Meier, & Wettstein, 2001).

The main assumptions of PPMS related to the practices of measuring and improving business processes can be included in several points. In practice, the point is that taking into account the goals of the organization and the objectives of business processes or ways of achieving them, managers can independently build indicators that will become helpful in developing knowledge about processes and process improvement. Obtained values of indicators in measuring processes should be compared with historical and target values, thanks to which it is possible to calculate and analyze cause–effect relationships (Kueng et al., 2001). Subsequently, such analyses may form the basis for classifying indicators due to their role in process improvement (e.g., lead indicators, early warning indicators, etc.). Obtained indicators should be the subject of analysis and conclusions regarding process configuration, process roles, resources, competences, information and IT support, communication systems, training needs, and many other aspects important for improving business processes.

2.3. Business Process Improvement and Industry 4.0

With the development of digital technologies – which enable the collection and processing of large amounts of data (big data), detailed measurements of implemented processes, and the integration of measures from various sources – new opportunities are emerging on an unknown scale to improve business processes in organizations. Nowadays, improving business processes creates new opportunities for making changes in the organization, including the reconstruction of business models and value chains in terms of new products or improved products, services, marketing and distribution channels, human resources, customer relations, and business partners.

The last three decades of the 20th century have brought the economy a new orientation in computerized development. Production automation obtained with the help of programmable controllers with memory has become a particularly significant example of development. As it turned out in later decades, it gave a new direction to the development of industry and other economic sectors in which human labor began to be replaced by the work of

machinery. The current fourth industrial revolution is characterized by the use of new information and communication technologies, which are based on the achievements of earlier initiated changes in the industry. Today, intelligent management systems are based on communication between machines or things (Internet of Things, IoT), are connected through networks, which in turn leads to the creation of intelligent factories (Roblek et al., 2016; Xu et al., 2018; Chen et al., 2018; Ghobakhloo, 2018; Yin et al., 2018). Cyber-physical production systems are created that communicate via the network, which means that in the future companies will increasingly replace people in business processes with intelligent machines and strive to develop autonomous algorithm-controlled work systems.

Improvement of business processes using IoT is associated with the collection of even more significant amounts of data (big data) about the possibilities provided by traditional management systems that were fed with data from human work. A large number of data requires a new IT environment, which is why cloud data warehouses are being developed that also provide data processing capabilities (Vera-Baquero et al., 2015; Vera-Baquero et al., 2016; Hwang et al., 2016; Wang & Zhao, 2016; Sachin S. Kamble et al., 2018; Horváth & Szabó, 2019; Galati & Bigliardi, 2019; Stjepić et al., 2020).

Business process researchers are facing new challenges, and the digital technologies introduced by Industry 4.0 provide new opportunities in achieving higher efficiency and effectiveness of business processes. Therefore, a growing interest of companies in this area should be expected, and achievements in the field of research and development will become the main driving force in increasing competitiveness.

3. Methodological aspects of research

Identifying research activity in the field of improving business processes and developing the process orientation of the organization and identifying potential research gaps was carried out using bibliometric methods and techniques. The resources of the Web of Science Core Collection database were used, which contains information on scientific publications in all scientific disciplines. The database allows you to collect data on scientific research, results obtained, dissemination, collaboration, and the impact of research on the development of the discipline. During the analyses, the development of research directions related to process improvement and process organization postulated at the turn of the 20th and 21st centuries as part of the developing Business Process Management trend was verified. First, all WoS publications related to Business Process Management were examined to build an idea of the importance of this

approach, especially in the areas of business, economics, management, and broadly understood IT research.

Bibliometric studies involve the use of mathematics and statistical methods in analyzing publications, especially books and other media (Pritchard, 1969). Bibliometry is a primary area of research relative to other related sciences, generally covering book editions, articles, and other publications. The term “bibliometrics” was first proposed by Otlet in 1934 (see Rousseau, 2014). Currently, bibliometry is one of the most important methods for researching the development of scientific disciplines. At the beginning of the first decade of the 20th century, it represented a methodological innovation in relation to traditional literature reviews. It is currently a standard in scientific work. The bibliometric analysis involves the use of statistical methods to determine qualitative and quantitative changes in given scientific research, to determine publication profiles, and to detect trends within a discipline (De Bakker, Groenewegen, & Den Hond, 2005). The bibliometric analysis provides useful information for experts wishing to evaluate scientific activities. It leads to finding information on searches conducted in a selected research area (Hirsch, 2005; Leydesdorff, 2006).

The Web of Science database used in the bibliometric study makes it possible to analyze research work in terms of many criteria, primarily: WoS categories (relating to scientific disciplines), authors of publications, year of publication, type of document (book, article, conference material, research message, etc.), organizations of researchers/authors, research funding agencies, source title (publishing house, magazine, database, etc.), book series, conferences, collective work editors, country or region of origin of authors, groups of authors, language publication, research area or grant number. In the presented study, to obtain answers to the research questions formulated subsequently, only selected distribution criteria were used, such as WoS category (referring to scientific disciplines), year of publication, country/territory, and type of publication.

The premises for undertaking bibliometric tests formulated in the introduction result from the literature studies conducted on the basis of which the main research problem was formulated:

RP: Are the research directions postulated in the initial period of Business Process Management development regarding process improvement and process organization reflected in the research papers published over the last two decades?

Resolving a research problem formulated in this way requires additional research questions, selection of sources of information, and determination of the research procedure. As a result, five research questions were formulated:

- RQ1) What is the popularity and dynamics of research devoted to Business Process Management (BPM)?*
- RQ2) What is the popularity and dynamics of research devoted to Business Process Improvement (BPI)?*
- RQ3) What is the interest of researchers in the Enterprise Performance Measurement System (PMS) and Process Performance Measurement System (PPMS)?*
- RQ4) What is the interest of researchers in the issue of Business Process Organization (BPO)?*
- RQ5) What is the level of relationship between research on improving business processes and Industry 4.0?*

It was also assumed that the terminology adopted has a key impact on the results of the research. At the same time, the research results indicate which terms have become common and which are not, which does not mean, however, that research issues are not undertaken. Detailed tracking of research issues in databases using keywords or phrases can contribute to building a reliable picture of the state of research.

4. Presentation and discussion of research results

The analysis of research work in the field of improving business processes and process organization began with identifying the dynamics of the development of management approaches under BPM. The first two publications indexed in WoS, which contain the term “business process management” (in the title, in the text or in keywords), come from 1992. Table 2.1 presents the list of publications for the phrase: “business process management,” according to the categories found in WoS. As of November 21, 2019, 35,672 records were obtained. It is worth noting that, with over 25% of publications, the most come from the Management area, over 18% come from the Computer Science Information Systems area and over 17% from the Business area. In addition to management, business, and economic sciences, the top places in this ranking are primarily computer science.

Table 2.1. Publications for “business process management” by the Web of Science category

WoS Categories	records	% of 35672
MANAGEMENT	9232	25.880
COMPUTER SCIENCE INFORMATION SYSTEMS	6629	18.583
BUSINESS	6233	17.473
COMPUTER SCIENCE THEORY METHODS	4064	11.393
OPERATIONS RESEARCH MANAGEMENT SCIENCE	3217	9.018
ENGINEERING ELECTRICAL ELECTRONIC	3150	8.830
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	3139	8.800
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	2562	7.182
ENGINEERING INDUSTRIAL	2532	7.098
ECONOMICS	2500	7.008
COMPUTER SCIENCE SOFTWARE ENGINEERING	2416	6.773
INFORMATION SCIENCE LIBRARY SCIENCE	1745	4.892
ENGINEERING MANUFACTURING	1597	4.477
EDUCATION EDUCATIONAL RESEARCH	1420	3.981
TELECOMMUNICATIONS	1147	3.215
ENVIRONMENTAL SCIENCES	1078	3.022
BUSINESS FINANCE	985	2.761
ENGINEERING MULTIDISCIPLINARY	915	2.565
SOCIAL SCIENCES INTERDISCIPLINARY	859	2.408
COMPUTER SCIENCE HARDWARE ARCHITECTURE	761	2.133
GREEN SUSTAINABLE SCIENCE TECHNOLOGY	748	2.097
ENVIRONMENTAL STUDIES	661	1.853
AUTOMATION CONTROL SYSTEMS	651	1.825
ENGINEERING ENVIRONMENTAL	577	1.618
REGIONAL URBAN PLANNING	495	1.388

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

The breakdown by year of publication (contained in Table 2.2) covers the period from 1996 to 2020. The number of publications related to the issues of business process management is steadily increasing. It should be recognized that the years 2018–2020 do not yet include all publications submitted for indexation. However, nothing indicates a trend reversal. Research is being developed in both the economic and technical sciences.

Table 2.2. Identified publications for “business process management” by year of publication

Publication years	records	% of 35672
2020	14	0.039
2019	2157	6.047
2018	2807	7.869
2017	3318	9.301
2016	3143	8.811
2015	2946	8.259
2014	2076	5.820
2013	2039	5.716
2012	1910	5.354
2011	1970	5.523
2010	1906	5.343
2009	1779	4.987
2008	1611	4.516
2007	1215	3.406
2006	1060	2.972
2005	860	2.411
2004	753	2.111
2003	657	1.842
2002	500	1.402
2001	465	1.304
2000	467	1.309
1999	405	1.135
1998	409	1.147
1997	394	1.105
1996	243	0.681

Source: own study based on <https://wcs.webofknowledge.com> (21.11.2019).

In the analyzed period of 1996–2017 (excluding 2018–2020), the highest citations were obtained in the field of information and information technologies, such as Faratin, Sierra, and Jennings (1998), Wooldridge, Jennings, and Kinny (2000), Al-Mashari, Al -Mudimigh, and Zairi (2003), van der Aalst, ter Hofstede, and Weske (2003) and Xu (2011). Table 2.3 presents a summary of the type of documents. Articles and conference materials were devoted to similar proportions for business process-management issues. The dynamics of research on modern technologies primarily determines the publishing policy.

The latest research achievements are presented either during field conferences or in articles of specialized magazines. The preparation of the monograph is time-consuming, and in many cases, is irrational due to rapidly changing technologies. The monographs created in this area are mainly of a review but also illustrative nature, especially for younger researchers.

Table 2.3. Identified publications for “business process management” by document types

Document types	records	% of 35672
ARTICLE	18450	51.721
PROCEEDINGS PAPER	17225	48.287
BOOK CHAPTER	944	2.646
REVIEW	878	2.461
EDITORIAL MATERIAL	181	0.507
EARLY ACCESS	111	0.311
BOOK REVIEW	21	0.059
BOOK	14	0.039
RETRACTED PUBLICATION	8	0.022
NOTE	6	0.017
REPRINT	6	0.017
MEETING ABSTRACT	4	0.011
CORRECTION	3	0.008
DATA PAPER	2	0.006
NEWS ITEM	1	0.003

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Interesting insights are provided by statements regarding the country of origin of researchers (Table 2.4). The United States and China, which are the largest suppliers of information technology supporting process management in organizations, are at the forefront. The results include publications both in the field of technical and economic sciences. However, the WoS database makes it impossible to perform cross-analyses that would confirm with certainty that the technical area determined the positions in this ranking. The second important observation concerns the significant participation of researchers and their publications from emerging markets such as Brazil, India, and European countries: Romania, Poland, and the Czech Republic.

Table 2.4. Identified publications for “business process management” by country/region

Countries/Regions	records	% of 35672
USA	5683	15.931
PEOPLES R CHINA	3796	10.641
ENGLAND	2939	8.239
GERMANY	2627	7.364
AUSTRALIA	1765	4.948
SPAIN	1483	4.157
ITALY	1351	3.787
NETHERLANDS	1122	3.145
FRANCE	1002	2.809
CANADA	955	2.677
BRAZIL	943	2.644
INDIA	923	2.587
ROMANIA	842	2.360
TAIWAN	824	2.310
RUSSIA	754	2.114
FINLAND	732	2.052
POLAND	686	1.923
SWEDEN	629	1.763
CZECH REPUBLIC	628	1.760
AUSTRIA	609	1.707
SOUTH KOREA	589	1.651
PORTUGAL	575	1.612
MALAYSIA	517	1.449
SWITZERLAND	470	1.318

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Searching for the answer to another research question related to the popularity and dynamics of research devoted to Business Process Improvement (BPI), an analysis of the listings of publications contained in the following tables was carried out. Table 2.5 includes a list of publications by categories in WoS, year of publication, and type of document. The use of the term ‘process improvement’ was intended to identify all publications in which the term appears in the title, abstract, or keywords. The list in Table 2.5 allows conclusions to be drawn primarily about the WoS category related to scientific disciplines. By far, the most scientific publications devoted to process

improvement have been prepared in the ICT environment. The first three items belong to such disciplines as Computer Science Software Engineering, Computer Science Information Systems, and Computer Science Theory Methods, and together, they cover about 48% of publications. In categories: management, operations management research science and business together, over 22% of all publications on process improvement were collected. It is also worth paying attention to the next items in Table 2.5, in the part referring to the WoS category. In addition to other sub-disciplines of information science, many publications come from industrial environments, among others: material engineering, chemical engineering, medicine or healthcare, telecommunications. The table shows 25 WoS categories, the most numerous in terms of indexed publications.

Table 2.5 also includes two other statements, obtained by year of publication and type of document. As in the previous case (analyses for BPM), the last three years (2018–2020) cannot be considered closed due to the ongoing indexation process. However, an upward trend can be seen for research work carried out in the field of process improvement. The dynamics of research are highlighted by the types of documents in which about 97% of all publications are articles and conference materials, with a small majority of articles in journals.

Table 2.6 presents the results obtained from WoS for publications containing the term “business process improvement” (BPI) in titles, abstracts, or keywords. This term narrows the search field, but it is a deliberate action that should be assumed to select publications related to the concept of Business Process Management. The extension of the term by the word “business” should at least suggest that the authors, when presenting the results of research related to process improvement, certainly refer them to organizational processes, classified according to the role they play in the implemented value chain of an enterprise, institution or other organization.

The number of all BPI publications accepted into the database is much smaller (319 records) than in the case presented in Table 2.5 regarding “process improvement” (7214 records). The first statement contained in Table 2.6 and relating to the WoS category puts management in third place among the 25 most numerous categories. This demonstrates the development of knowledge about the process approach to management and the business approach to processes implemented in enterprises. At this point, one could risk the thesis about increased penetration of knowledge about the possibilities of improving processes from the ICT area to the managerial environment. One cannot ignore the fact that the popularity of research in the field of business process improvement is the highest in the IT and engineering environment in industrial sectors.

Table 2.5. “Process improvement” publications by Web of Science category, year of publication and type of document

Showing 7,214 records for TOPIC: ("process improvement")									
Web of Science Categories	records	% of 7214	Publication Years	records	% of 7214	Document Types	records	% of 7214	
COMPUTER SCIENCE SOFTWARE ENGINEERING	1696	23.510	2020	3	0.042	ARTICLE	3932	54.505	
COMPUTER SCIENCE INFORMATION SYSTEMS	898	12.448	2019	358	4.963	PROCEEDINGS PAPER	3080	42.695	
COMPUTER SCIENCE THEORY METHODS	877	12.157	2018	487	6.751	MEETING ABSTRACT	280	3.881	
MANAGEMENT	753	10.438	2017	566	7.846	REVIEW	199	2.759	
ENGINEERING ELECTRICAL ELECTRONIC	716	9.925	2016	547	7.582	EDITORIAL MATERIAL	110	1.525	
OPERATIONS RESEARCH MANAGEMENT SCIENCE	604	8.373	2015	466	6.460	BOOK CHAPTER	94	1.303	
ENGINEERING INDUSTRIAL	594	8.234	2014	425	5.891	LETTER	15	0.208	
ENGINEERING MANUFACTURING	422	5.850	2013	394	5.462	EARLY ACCESS	12	0.166	
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	388	5.378	2012	363	5.032	BOOK REVIEW	8	0.111	
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	340	4.713	2011	348	4.824	NEWS ITEM	5	0.069	
ENGINEERING MULTIDISCIPLINARY	269	3.729	2010	348	4.824	BOOK	3	0.042	
BUSINESS	235	3.258	2009	314	4.353	CORRECTION	3	0.042	
HEALTH CARE SCIENCES SERVICES	217	3.008	2008	312	4.325	NOTE	2	0.028	
NURSING	211	2.925	2007	252	3.493	DATA PAPER	1	0.014	
ENGINEERING CHEMICAL	190	2.634	2006	225	3.119	DISCUSSION	1	0.014	
MATERIALS SCIENCE MULTIDISCIPLINARY	176	2.440	2005	216	2.994	REPRINT	1	0.014	
SURGERY	176	2.440	2004	142	1.968	SOFTWARE REVIEW	1	0.014	
ENGINEERING MECHANICAL	157	2.176	2003	161	2.232				
TELECOMMUNICATIONS	157	2.176	2002	162	2.246				
COMPUTER SCIENCE HARDWARE ARCHITECTURE	151	2.093	2001	130	1.802				
INFORMATION SCIENCE LIBRARY SCIENCE	149	2.065	2000	145	2.010				
HEALTH POLICY SERVICES	141	1.955	1999	133	1.844				
ENERGY FUELS	118	1.636	1998	143	1.982				
AUTOMATION CONTROL SYSTEMS	113	1.566	1997	181	2.509				
ENVIRONMENTAL SCIENCES	112	1.553	1996	93	1.289				

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Analyzing the distribution according to the year of publication, first of all, interest is generated by the publication jump, which occurred for the first time in 2013, in which the number of publications doubled and 2016, in which, after three years at a comparable level, a significant increase in indexed publications can be seen dedicated to BPI. There are a significantly smaller number of publications in the field of BPI in relation to PI. It shows a relatively new, developing approach to process improvement, and certainly a new perspective for conducting research in the field of process improvement in organizations that are increasingly seen as business processes. Implementation of the new approach in the engineering environment probably occurs more slowly, due to the obvious focus on selected technological processes. The distribution of identified publications by type of document indicates inverse proportions in relation to the statements regarding PI. In this case, the conference materials emphasize the dynamics and relatively young approach to process analysis in organizations.

Process improvement in business terms requires performance measurements in an economic sense. Research experience expressed in the numbers of scientific publications in this area can be analyzed in two perspectives: performance testing related to the entire organization and performance testing of individual processes. At this stage of identifying research directions for improving business processes, two terms were introduced according to which the resources contained in the WoS database were compiled: performance measurement system and process performance measurement system. Tables 2.7 and 2.8 present the breakdown by categories included in WoS for four measurements. The purpose of this study was to check the popularity of terms related to testing the efficiency of processes that occur in the literature on the subject, and in the initial period of BPM development were even postulated (see Kueng et al., 2001; Neely et al., 2005; Tatitcchi et al., 2010). Table 2.7 presents lists of publications in which (in titles, abstracts, or keywords) the system has found configurations for the words contained in the phrase business process performance measurement. One thousand six hundred sixty-one records have been identified that match these search criteria. The first statement in Table 2.7 presents the number of publications in the twenty-five most numerous WoS categories. In this particular case, the categories: management, business, and operations research management science were in the lead, first, second, and fourth, respectively. Together, these three categories comprise over 60% of publications. The second presentation in Table 2.7, by narrowing down the use of the phrase “business process performance measurement”, covers the opposite situation, because only seven publications were obtained. It should be noted, however, that the full phrase should be used either in the title or in the abstract or keywords. This result, at this stage of research, cannot be an indicator of the popularity or dynamics of research in the field of business process efficiency.

Table 2.6. Publications devoted to “business process improvement” by Web of Science category, year of publication and type of document

Showing 319 records for TOPIC: ("business process improvement")						
Web of Science Categories	records	% of 319	Publication Years	records	% of 319	Document Types
COMPUTER SCIENCE INFORMATION SYSTEMS	90	28.213	2019	8	2.508	PROCEEDINGS PAPER
COMPUTER SCIENCE THEORY METHODS	66	20.690	2018	24	7.524	ARTICLE
MANAGEMENT	59	18.495	2017	37	11.599	REVIEW
ENGINEERING ELECTRICAL ELECTRONIC	52	16.301	2016	36	11.285	BOOK CHAPTER
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	44	13.793	2015	23	7.210	BOOK REVIEW
COMPUTER SCIENCE SOFTWARE ENGINEERING	42	13.166	2014	24	7.524	CORRECTION
OPERATIONS RESEARCH MANAGEMENT SCIENCE	41	12.853	2013	23	7.210	EDITORIAL MATERIAL
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	36	11.285	2012	11	3.448	
ENGINEERING INDUSTRIAL	34	10.658	2011	13	4.075	
ENGINEERING MANUFACTURING	31	9.718	2010	12	3.762	
BUSINESS	22	6.897	2009	20	6.270	
INFORMATION SCIENCE LIBRARY SCIENCE	16	5.016	2008	9	2.821	
ENGINEERING MULTIDISCIPLINARY	13	4.075	2007	8	2.508	
TELECOMMUNICATIONS	10	3.135	2006	6	1.881	
ECONOMICS	8	2.508	2005	8	2.508	
COMPUTER SCIENCE CYBERNETICS	7	2.194	2004	5	1.567	
AUTOMATION CONTROL SYSTEMS	6	1.881	2003	6	1.881	
EDUCATION EDUCATIONAL RESEARCH	6	1.881	2002	5	1.567	
ENGINEERING MECHANICAL	5	1.567	2001	5	1.567	
BUSINESS FINANCE	4	1.254	2000	7	2.194	
COMPUTER SCIENCE HARDWARE ARCHITECTURE	4	1.254	1999	4	1.254	
CONSTRUCTION BUILDING TECHNOLOGY	4	1.254	1998	7	2.194	
MEDICAL INFORMATICS	4	1.254	1997	5	1.567	
PHYSICS APPLIED	4	1.254	1996	2	0.627	
PUBLIC ADMINISTRATION	3	0.940	1995	2	0.627	

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Table 2.7. Lists for publications from the area of “business process performance measurement”

Showing 1,661 records for TOPIC: („business process performance measurement”)				Showing 7 records for TOPIC: („business process performance measurement”)			
Web of Science Categories	records	% of 1661	Web of Science Categories	records	% of 7		
MANAGEMENT	500	30.102	BUSINESS FINANCE	3	42.857		
BUSINESS	305	18.362	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	3	42.857		
COMPUTER SCIENCE INFORMATION SYSTEMS	257	15.473	MANAGEMENT	2	28.571		
OPERATIONS RESEARCH MANAGEMENT SCIENCE	205	12.342	AUTOMATION CONTROL SYSTEMS	1	14.286		
ENGINEERING INDUSTRIAL	174	10.476	BUSINESS	1	14.286		
ENGINEERING MANUFACTURING	141	8.489	COMPUTER SCIENCE INFORMATION SYSTEMS	1	14.286		
ENGINEERING ELECTRICAL ELECTRONIC	131	7.887	COMPUTER SCIENCE THEORY METHODS	1	14.286		
COMPUTER SCIENCE THEORY METHODS	122	7.345	ECONOMICS	1	14.286		
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	117	7.044	ENGINEERING ELECTRICAL ELECTRONIC	1	14.286		
ECONOMICS	117	7.044	MULTIDISCIPLINARY SCIENCES	1	14.286		
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	109	6.562	OPERATIONS RESEARCH MANAGEMENT SCIENCE	1	14.286		
COMPUTER SCIENCE SOFTWARE ENGINEERING	90	5.418	MULTIDISCIPLINARY SCIENCES	1	14.286		
BUSINESS FINANCE	82	4.937	OPERATIONS RESEARCH MANAGEMENT SCIENCE	1	14.286		
INFORMATION SCIENCE LIBRARY SCIENCE	62	3.733					
ENVIRONMENTAL SCIENCES	52	3.131					
TELECOMMUNICATIONS	46	2.769					
GREEN SUSTAINABLE SCIENCE TECHNOLOGY	45	2.709					
ENGINEERING MULTIDISCIPLINARY	40	2.408					
EDUCATION EDUCATIONAL RESEARCH	31	1.866					
ENGINEERING CIVIL	30	1.806					
ENGINEERING ENVIRONMENTAL	27	1.626					
ENGINEERING MECHANICAL	27	1.626					
SOCIAL SCIENCES INTERDISCIPLINARY	27	1.626					
COMPUTER SCIENCE HARDWARE ARCHITECTURE	26	1.565					
ENVIRONMENTAL STUDIES	25	1.505					

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Table 2.8. Lists for publications related to “process performance measurement” and “performance measurement”

Showing 39 records for TOPIC: (“process performance measurement”)		Showing 10,863 records for TOPIC: (“performance measurement”)	
Web of Science Categories	records	% of 39	records
COMPUTER SCIENCE INFORMATION SYSTEMS	12	30.769	2126
MANAGEMENT	10	25.641	19,571
COMPUTER SCIENCE THEORY METHODS	7	17.949	1122
OPERATIONS RESEARCH MANAGEMENT SCIENCE	7	17.949	1067
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIO	6	15.385	904
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	5	12.821	902
ENGINEERING INDUSTRIAL	4	10.256	864
BUSINESS	3	7.692	805
BUSINESS FINANCE	3	7.692	7,410
COMPUTER SCIENCE SOFTWARE ENGINEERING	3	7.692	684
ECONOMICS	3	7.692	633
ENGINEERING ELECTRICAL ELECTRONIC	3	7.692	630
ENGINEERING MANUFACTURING	3	7.692	568
ENGINEERING MULTIDISCIPLINARY	2	5.128	529
AUTOMATION CONTROL SYSTEMS	1	2.564	504
DEVELOPMENT STUDIES	1	2.564	463
ENERGY FUELS	1	2.564	453
ENGINEERING CIVIL	1	2.564	368
GREEN SUSTAINABLE SCIENCE TECHNOLOGY	1	2.564	337
HEALTH POLICY SERVICES	1	2.564	323
INFORMATION SCIENCE LIBRARY SCIENCE	1	2.564	297
MEDICAL INFORMATICS	1	2.564	262
MULTIDISCIPLINARY SCIENCES	1	2.564	249
PHYSICS MULTIDISCIPLINARY	1	2.564	248
PUBLIC ADMINISTRATION	1	2.564	216
	1	2.564	215
	1	2.564	197

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Table 2.9. Lists for publications related to “business process orientation”, “process organization” and “process oriented organization”

Showing 51 records for TOPIC: (“business process orientation”)			Showing 332 records for TOPIC: (“process organization”)			Showing 27 records for TOPIC: (“process oriented organization”)		
Publication Years	records	% of 51	Publication Years	records	% of 332	Publication Years	records	% of 27
2019	4	7.843	2019	18	5.422	2018	3	11.111
2018	5	9.804	2018	34	10.241	2016	2	7.407
2017	4	7.843	2017	32	9.639	2015	2	7.407
2016	2	3.922	2016	28	8.434	2013	3	11.111
2015	2	3.922	2015	33	9.940	2012	3	11.111
2014	2	3.922	2014	17	5.120	2011	1	3.704
2013	4	7.843	2013	17	5.120	2010	2	7.407
2012	2	3.922	2012	11	3.313	2009	2	7.407
2011	4	7.843	2011	7	2.108	2008	2	7.407
2010	5	9.804	2010	14	4.217	2003	3	11.111
2009	2	3.922	2009	11	3.313	2001	1	3.704
2008	3	5.882	2008	15	4.518	1998	1	3.704
2007	1	1.961	2007	6	1.807	1995	1	3.704
2006	1	1.961	2006	13	3.916	1994	1	3.704
2004	3	5.882	2005	9	2.711			
2003	1	1.961	2004	9	2.711			
2002	1	1.961	2003	8	2.410			
2001	2	3.922	2002	4	1.205			
1999	2	3.922	2001	2	0.602			
1994	1	1.961	2000	3	0.904			
			1999	4	1.205			
			1998	4	1.205			
			1997	6	1.807			
			1996	5	1.506			
			1995	2	0.602			

Source: own study based on <https://wvcs.webofknowledge.com> (21.11.2019).

Table 2.8 presents the results of the publication for “process performance measurement” and “performance measurement.” Each narrowing of the search field occurs by extending the term by new words, which is presented in 2.8. In this case, the word narrowing the research field was “process.” The issue of measuring performance was found in over ten thousand publications (10,863 records), while the issue of measuring process efficiency was found only in 39 publications. Interest in research in the field of measuring performance is undoubtedly the domain of the management environment, operational research, business, and economic sciences. Categories such as Computer Science Information Systems and Computer Science Theory Methods remain invariably at the forefront of Table 2.8. The environment of industrial, electrical, and electronic engineering, as well as production, is strongly represented. The obvious result seems to be a high position for Business Finance in measuring performance. The results of both combinations indicate relatively undeveloped research issues in the field of measuring process efficiency. This demonstrates the still high dominance of measurement methods and the indicators used and developed in functionally oriented organizations, where cost monitoring is still possible about functional areas. Process performance testing should be considered as an emerging area. However, there are no reasons to consider that this is a significantly popular or development area in relation to performance measurement systems used in business.

The next two presentations of results in Table 2.9 refer to the popularity analysis of the issues of the orientation of the organization towards business processes. Three terms were used to test the popularity of research topics: “business process-oriented,” “process-oriented” and “process-oriented organization.” The number of indications is the highest for the organization of the process (332 records), in which the term was narrowed down to two words and, at the same time, gained the widest field. The concept of process organization was assumed to be ambiguous. Therefore the analysis was conducted in terms of popularity in terms of WoS, as shown in Table 2.10.

Interesting, against the background of other analyses carried out taking into account the WoS category, is the share of the category Education and Educational Research with the highest number of records (51), which may indicate the ambiguity of the term. Further studies should clarify the meaning of the term used. Analyses taking into account the year of publication indicate progress in relation to “process organization,” which cannot be said about other analyses taking into account the terms business process orientation and process-oriented organization.

Table 2.10. Lists for publications related to “process organization” by WoS category

Showing 332 records for TOPIC: („process organization”)		
Web of Science Categories	records	% of 332
EDUCATION AND EDUCATIONAL RESEARCH	51	15.361
MANAGEMENT	42	12.651
COMPUTER SCIENCE INFORMATION SYSTEMS	29	8.735
BUSINESS	28	8.434
ENGINEERING ELECTRICAL ELECTRONIC	27	8.133
OPERATIONS RESEARCH MANAGEMENT SCIENCE	23	6.928
ENGINEERING MANUFACTURING	21	6.325
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	20	6.024
ENGINEERING INDUSTRIAL	19	5.723
COMPUTER SCIENCE THEORY METHODS	18	5.422
ECONOMICS	15	4.518
SOCIAL SCIENCES INTERDISCIPLINARY	12	3.614
COMPUTER SCIENCE SOFTWARE ENGINEERING	11	3.313
ENGINEERING MECHANICAL	10	3.012
COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	9	2.711

Source: own study based on <https://wos.webofknowledge.com> (21.11.2019).

Lastly, an attempt was made to identify research in which business process improvement was linked to Industry 4.0. Currently, one of the key challenges for business entities is to ensure efficient, effective, and flexible access to information and to provide all possible communication channels. Today’s world is becoming more and more mobile, and users often do their work with several different devices during the day. Therefore, unified access to networks, servers, memory, applications, and services is needed. To achieve this goal, these resources can no longer be on local devices. They should be integrated, and according to the possibilities offered by 4.0 technologies, should live in the “cloud” and be available through network services for a wide spectrum of devices from different locations. Cloud computing is still an evolutionary paradigm that is rather difficult to define but is usually described as convenient on-demand network access to a shared pool of configurable computing resources that can be quickly shared and released with minimal effort or the interaction management service of actors processes and customer interactions.

The study was based on searching for publications by combining two phrases: “business process improvement” and “process improvement” with terms specific to the fourth industrial revolution (Table 2.11). Considering the popularity of the issues of process improvement (business and other), it should

be noted that the research is in its beginning phase. The first publications are being created, but one cannot talk about a clearly outlined trend.

Continuous process improvement through the strategic implementation of innovative information and communication technologies is necessary for the long-term survival of companies on the market. Unfortunately, today's organizations, excluding major market-leading multinational corporations, generally have difficulty keeping up with advances in technology and software. The Internet of Things, intelligent factory, cloud computing, and other upcoming technologies and trends have probably already been noticed, but for many entities, they are still a distant implementation.

Table 2.11. The number of publications indexed in WoS in the field of process improvement in the Industry 4.0 perspective

Research area	records	Research area	records
„business process improvement” and „industry 4.0”	1	„process improvement” and „industry 4.0”	20
„business process improvement” and „economy 4.0”	0	“process improvement” and „economy 4.0”	0
„business process improvement” and „big data”	0	„process improvement” and „big data”	0
„business process improvement” and „internet of things”	1	„process improvement” and „internet of things”	13
„business process improvement” and „smart environment”	0	„process improvement” and „smart environment”	0
„business process improvement” and „smart factory”	0	„process improvement” and „smart factory”	1
„business process improvement” and „internet of services”	0	„process improvement” and „internet of services”	0
„business process improvement” and „smart product”	0	„process improvement” and „smart product”	0
„business process improvement” and „M2M”	0	„process improvement” and „M2M”	0
„business process improvement” and cloud	1	„process improvement” and cloud	20

Source: own study based on <https://wos.webofknowledge.com> (4.07.2020).

5. Conclusion

The presented bibliometric analysis was carried out to check how popular are the research directions related to the improvement of business processes and process-oriented organizations, and whether the conducted research includes the Economy 4.0 perspective. The postulate of a comprehensive approach to process improvement and process organization improvement should be treated

as an emerging direction of research within Business Process Management. The popularity of this direction of research is still low, as well as the dynamics expressed in the number of publications in 1996–2017 (excluding 2018–2020). The presented study can be considered as a preliminary basis for determining research gaps and emerging new research areas. However, accurate profiling of research areas requires further, in-depth analyses of publications collected in the WoS database and other databases. The results obtained in WoS should be confronted with data obtained from databases of a similar degree of popularity, interdisciplinarity, geographical coverage, and the scope of research and publication work carried out.

The terms used in the presented research: business process improvement, business process performance measurement, process-oriented organization, industry 4.0, technologies 4.0 should be used in subsequent detailed cross-analyses related to such aspects of business process improvement as methods, techniques, and tools used in measurements processes, design, and implementation of improvements, with particular emphasis on digital technologies. Social aspects are another important and developed aspect of process and organization improvement. Research issues such as organizational culture or process thinking, process, and digital competences are gaining popularity, which can be an important area for developing interpretations for changes occurring in organizations related to process orientation or process work organization in the developing Economy 4.0.

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Biographical note

Natalia R. Potoczek (Ph.D., Hab.), Professor at Institute of Economics, Polish Academy of Sciences (INE PAN) in Warsaw. She is a researcher at the Laboratory of Process and Network Analysis at INE PAN, Vice President of the Board of the Cognitione Foundation for the Dissemination of Knowledge and Science and a member of the Academy of Management, NY, USA. As an editor, reviewer and managing director, she works at the scientific Journal of Entrepreneurship, Management and Innovation (JEMI) and works for the transfer of knowledge between science, business, and the public sphere. She is an Associate Professor at the Wyższa Szkoła Biznesu – National-Louis University. Also, she carries out research and implementation projects. In research and consulting, she combines her knowledge and many years of experience in two areas: business process management and human resource management.

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Development of key competencies of Polish organizations' employees in the face of the fourth industrial revolution

Michał Igielski¹

Abstract

The main aim of the study is to try to determine the determinants of developing the competencies of key employees in the context of threats, but also, of course, opportunities that accompany the fourth industrial revolution. The author will also evaluate actions taken by companies that took part in the research process, which are aimed at eliminating threats or taking advantage of opportunities that are brought about by these changes in the economy. In addition to a literature analysis, the author has chosen as another research method an interview with senior managers in the surveyed entities – the research was carried out in 2019 in 14 specifically selected large enterprises, which have their headquarters in Poland (a total of 77 people took part in the research). After analyzing the literature and the results of the conducted research, it turned out that in the Polish reality, despite an awareness of the opportunities and threats posed by the fourth industrial revolution (also in the area of human capital management), no preventive steps were taken or action strategies created to help them function in a diametrically changing environment.

Keywords: *competences, competence management, key employees, Industrie 4.0*

1. Introduction

Bearing in mind the direction of research chosen by the author of the article, which for many years has been related to the identification of key employees in Polish organizations and the impact of their competences on building a competitive advantage in the modern economic market, the main objective of the study, defined this time, can be considered consistent with

¹ Michał Igielski, Ph.D., Faculty of Entrepreneurship and Quality Science, Department of Economics and Economic Policy, Gdynia Maritime University, 81–87 Morska, St. 81–225 Gdynia, Poland e-mail: m.igielski@wpit.umg.edu.pl (ORCID ID: <https://orcid.org/0000-0003-4680-3733>).

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his empirical experience to date. In addition, the author will also evaluate actions taken by organizations that took part in the research process, aimed at eliminating threats or taking advantage of opportunities that are brought about by changes in the economy.

Literature analysis and empirical research have shown that the fourth industrial revolution brings with it many very important changes in the areas related to employee management in modern organizations. We can see specific conditions and determinants related to this process. However, the actions taken by organizations in this area definitely contradict the identified situation – people responsible for these areas do not understand the importance of this situation, and the level of introduced changes is very low. This certainly means that Poland's distance to the richest and most developed countries is still of a structural nature. One thing is certain: the Polish economy, which aspires to catch up with the most developed economies, cannot afford to wait for developments and not to implement specific actions that would turn threats into opportunities for even faster development.

We can certainly say that the competences of key employees will remain a permanent element of management, as they have become tangible assets, organizational structures, strategies, processes, systems, financial, or information resources. On the other hand, looking at the permanent changes that are constantly taking place in the economy, the determinants related to the management of this most important value for organizations in the 21st century will change. All the more so in the face of the fourth industrial revolution, related to automation, data exchange, and artificial intelligence. Therefore, according to the author of the study, we have to adapt management to new conditions and leveling new barriers standing in the way of the optimal use of the potential of this group of employees. In science, on the other hand, we can hope that the need to develop new conceptual frameworks and methods of studying the management of key employees in companies will not disappear. The author also hopes that the research presented in this study is conducted in the right direction.

According to the author, the research tasks carried out in this study made it possible to develop and implement the initial objectives of the prepared material. However, the obtained conclusions can be applied theoretically and practically – to better learn, understand and improve the management of key employees' competences in the face of new challenges.

2. Literaturree background

2.1. The origins and characteristics of the fourth industrial revolution

If we count the digital revolution included in the title of the study and follow the whole history of economic development, we can consider it to be the fourth such phenomenon. Previous revolutions were defined differently – from neolithic, through industrial to informational. However, it is not the name that is most important here, but the two main features. This distinguishes a given revolution from similar but much smaller and less significant technical or technological changes. First of all, it is about the very large size of the changes taking place, which have been triggered by a revolutionary discovery. We must remember, however, that the appearance of a new invention becomes revolutionary only when the invention is widely used and the changes it causes spread to practically all areas of economic and social life. The second most important feature is the assignment of a unique and unambiguously associative word (name), which completely describes the character of a given revolution.

The first industrial revolution (the end of the 18th century – the first half of the 19th century) concerned the transition from artisanal and manufacturing production to mechanized factory production – thanks to the intensive use of a large number of technical inventions and changes in the organization of work processes. For the man working in the factory, the most important was the invention of the steam machine, which was also used in mining and the textile industry. The new machines used in production required them to be made of durable construction materials. The replacement of charcoal with coke in metallurgy proved to be a breakthrough. This allowed for the development of the machinery industry. In turn, the beginning of the second revolution falls in the 1870s. The greatest innovations that revolutionized and boosted the industry at that time were two new energy sources: electricity (electric motor) and the combustion engine. The era of mass production began with the division of labor and fragmentation of work. The next, third, revolution began in the late 1960s. It was triggered by the industrial use of programmable controllers (1968), opening an era of industrial automation based on advanced electronics and information technologies (Furmanek, 2018).

The fourth industrial revolution, on the other hand, began at the beginning of the first decade of the 21st century and is closely linked to the large-scale use of information technology in industry with the processing and exchange of data, which can be observed through the continuous development of automation, not only of production processes but also of the organization of the management of all processes.

In fact, the final name of what is just being crystallized has not yet been agreed – terms such as Industry 4.0, the smart factory, the smart enterprise, the internet of things and services, the internet of everything, or the industrial internet. After mechanization, electrification and automation, there is digitisation and digitisation. This was made possible by the development of IT communication systems, mobile robotics, automation, and additive manufacturing. The new formula of operation of people, business entities and households is (will be) based on a wireless and wired communication connection of unambiguously addressed (many) mobile and stationary smart devices jointly realizing and materializing a physical product or service. All this together makes the epoch after the fourth industrial revolution different from the current anthropopressure (Janikowski, 2017).

Attempts to name this next industrial revolution result from the definition of terms used to describe technological processes and the rules of functioning of modern enterprises on the market, which systematically use systems and cyberphysical modeling, the Internet of things and services, cloud computing capabilities, the Internet of All (<http://przemysl-40.pl/index.php/2017/09/12/przemysl-4-0-raporty-i-publikacje/>). On the other hand, it has become a fact that the fourth industrial revolution pays attention to the speed and quality of transmitted information, and the basis of these transformations remains Information and Communication Technologies (ICT). The growing pace of the spread of ICT has led to the fact that more and more often we start talking about the fourth industrial revolution, which is distinguished from the previous one by its universality. This phenomenon is becoming so clear that already today, government programs of individual countries are calling for preparation for these changes and the maximum possible use of their potential. For several years now, we have been talking more and more often about the very rapid development of new technologies, their increased availability, and high personalization of the technical solutions introduced. Today, ICTs are present in the modern economy in practically every sector (not only in industry) and accompany both the professional and private sphere of more and more people. The trend of mobility of electronic services, which has been observed for several years, is particularly strong – they are becoming a part of the daily life of a digital society and are very quickly applied in the production process, logistics, transport, health, banking, and the public sector. Although the two recent revolutions are based on a similar element, i.e. information, it is currently not just about collecting it but about fast processing of large amounts of data and skilful use of it (Olender-Skorek, 2017).

This means that an employee of company 4.0 is an open and active person who likes diversity, both in terms of contact with people and tasks. He has the ability to communicate very technical and detailed information to others

with enthusiasm and optimism. This makes the audience feel positive about the ideas they share. He attaches great importance to details and strives for perfection. He ensures a high quality of work and compliance with standards. He follows the rules and procedures. On the other hand, he should no longer concentrate only on his narrow specialization. He should have the ability to understand concepts and concepts from other fields. He must be open to changes both in his area of specialization and in the team he works in. It is the team character of work that requires from him highly developed interpersonal skills. Of course, one cannot forget that technical knowledge will remain the foundation. However, new areas of technical competence will also be important, e.g.: integration of IT systems control systems, programming of industrial robotic teams, integration of analytical systems in data clouds with local systems, cyber security or the application of artificial intelligence algorithms in automation systems (Gorustowicz, 2019).

To sum up, all of the revolutions to date have made huge changes to production processes, mainly related to the possibilities of mass production and, what is important, the effective production of products and provision of services. They were accompanied by changes in the impact on the organization's internal environment, including on people. The new, so-called industry 4.0 transforms and integrates processes taking place in the organization in a horizontal manner – from purchase through production, logistics to accompanying services. We must remember that the changes described above have a very large impact on the functioning of national economies. Especially those that are at the development stage, such as Poland, which is constantly trying to catch up with developed countries economically. After all, it is the industrial production sector that is the main driving force of the Polish economy, which is still growing after the crisis of 2009. Therefore, it is very important for us that we must be prepared for the new economic conditions and we must prepare our key employees for them.

2.2. The essence of key employees in the organization

A smart organization is one that is constantly developing its ability to adapt to a changing and unpredictable environment. It also acquires, creates and stores knowledge and uses it to improve its performance or produce an innovative product (Bratinau, Vasilache, & Jianu, 2006, p. 73). An intelligent organization is often also called a learning organization and in this context it is defined as one that continuously learns and practises to achieve mastery of improvement (Senge, 2004). These two definitions already clearly indicate the very important role of employees who work in an organization, showing their knowledge, skills and experience. It is the contemporary economic reality that

forces the management boards to recruit (when analyzing the situation on the labor market one can get the impression that it already belongs to an employee) and retain (according to the author, this process is even more complicated than the recruitment itself) people with high potential. The 21st century requires companies to constantly improve and introduce innovations. This activity is determined by the potential of key people for the organization, built by a group of factors of mutual relations between the company and the employed staff.

Carter (2009) defines the notion of people considered to be key to an organization through high potential as combining ability and commitment with aspirations for development, promotion, and key roles in the organization. Abilities are defined here as agility in learning and consist of innate skills – intellectual fitness and emotional intelligence, and acquired technical and interpersonal skills that are used in everyday work. Abilities also include the predisposition to: process complex ideas, think logically, see and understand other people's emotions, and learn new skills, e.g. technical, interpersonal. In contrast, E. van Staden (2011) describes the high potential of a key worker by giving attributes related to leadership skills, the ability to analyze and synthesize large amounts of information and to deal with uncertain and unclear situations. It also points to the passion for continuous learning, improving the existing situation and the ability to cooperate and communicate with other employees. In turn, Fernández-Aráo (2014) defines this issue as the ability to adapt and develop within very complex tasks and environments. He draws attention to five characteristics of an employee with potential. The first of these is the pursuit of excellence in achieving a given goal. This is expressed in the employee's ambitions and expectations of recognition, but also in his modesty and continuous investment in his own skills. The second feature is curiosity, which means the willingness to look for news, acquire knowledge, seek feedback, as well as an openness to learning and change. The third feature is perspicacity defined as the ability to collect and draw conclusions from information that can create new opportunities. The fourth feature is engagement described as talent (to use knowledge) and logic (to share one's vision with others). The fifth feature is determination – the ability to fight for complex goals and deal with difficulties and adversities.

It is worthwhile trying at this point to systematize the quoted definitions in a certain way and to refer to the four factors characterizing a high-potential employee, as follows (Ready, Conger, & Hill, 2010):

- 1) The pursuit of excellence – the constant pursuit of success can lead to extreme results. It is not enough to achieve only very good results at work, but you have to be the best – even at the expense of your personal life.

- 2) Accepting and using knowledge in business processes – in order to be recognized as a key employee, one has to learn throughout one's life – to draw knowledge and experience from every situation – both in professional and personal life.
- 3) Entrepreneurial spirit – key employees must not be afraid to leave their comfort zone (professionally and personally). They must adapt their personal style and develop new strategies. They must also be able to take responsibility – the new challenges mean playing a supportive role and doing things under influence, not under direct control.
- 4) Ability to respond appropriately – high capacity also poses great challenges in taking key decisions. This is linked to the risk of making mistakes – all of which can be a source of stress. A key worker must be aware of this and react properly (without emotion) in every situation.

All these qualities and skills should be assessed not only from a current perspective, but above all from a long-term perspective. This approach is important in planning the success of an organization. For example, commitment is the degree to which an employee sacrifices his or her abilities for the organization. The results of a high level of an employee's commitment are their hard and long-term work and their civic attitude, i.e. engaging not only in obligations resulting from the signed contract or agreement (Zdonek & Wolny, 2015).

So who is the key employee and how to identify him/her? How to explore and assess his unique potential? According to the author of the study, the main elements that may prove the role of a given employee in a domestic organization include: motivation, determination, creativity, and conceptual skills. Why just these four, not a dozen or so others? Because they best reflect the employee of the 21st century and are the answer to most determinants of the modern market. Beginning with motivation, the author means a very high level of involvement in the work and thus, the pursuit of a given goal. After all, people with high potential are usually very ambitious, constantly striving for self-perfection. They also expect recognition from others, which makes them contribute to common goals. This factor is strongly linked to the latter, i.e. determination understood in this case as the ability to fight for even the most complicated assumptions. It is also dealing with the pressure and other difficulties that accompany everyday work. Another feature is creativity – the result of curiosity to learn. It manifests itself in searching for novelties, new solutions and acquiring knowledge, which is necessary for this process. Such a person is not afraid of changes, but directly proportionally expects them, and is often the initiator of them. The last feature is conceptual skills, which allow an understanding of the general functions of the organization and its environment. This employee understands how many parts of the organization come together and can share his own vision with others.

2.3. Description of the main key competences of employees

The concept of competence derives from the Latin word *competentia*, which means responsibility or compliance. Nowadays, our competences determine what kind of work and how much money we will have. For many years, in the author's opinion, not entirely correctly, they have been identified with the privilege of holding a specific position within which, on behalf of a given organization, that person is entitled to make binding decisions. The very concept of competence has evolved considerably over the recent years and it is extremely difficult, or rather impossible, to find a single, coherent definition of this concept.

The precursor of this topic was McClelland (1973), who, in the 1970s, introduced this concept to the canon of science. When examining the careers of university graduates, he noted that university grades are usually not associated with professional success. Therefore, he suggested that intelligence tests should be replaced by the study of traits, which he called the competences, which consist of: knowledge, skills, abilities and personality traits needed for proper work. In the 1980s, Boyatzis (1982) developed a new definition that took into account the potential that exists in a person, leading to behavior that contributes to meeting the requirements of the job within the parameters of the organization's environment. Later, the most complete definition of competence is given by Whiddett and Hollyforde (2003), who state that competence in the scope of performed work is a set of characteristics of a given person, which consists of elements characteristic of that person, such as motivation, personality traits, skills, self-esteem connected with functioning in a group and knowledge that that person has acquired and uses. In Poland, for example, Nogalski and Śniadecki (2006) define competences as closely integrated organizational, conceptual, administrative, technical and interpersonal skills. Bartkowiak (2011) believes that the competences of key employees are the perception of attitudes, goals, motivations and attitudes of individuals, knowledge of social structures and social skills (such as motivating, communicating, ability to evaluate an employee's team), the ability to use knowledge in practice, as well as effective implementation of objectives. A definition worth mentioning was formulated by Oleksyn (2010) – it consists of: internal motivation, aptitudes and predispositions, knowledge, education, experience and practical skills, health and fitness and other psychophysical characteristics important for work processes, attitudes, and behaviors expected in the workplace and formal entitlements to act.

To sum up briefly the above-mentioned definitions, we can notice that the authors place particular emphasis on the exchange of knowledge and education as key competences in the 21st century. The reason for this

situation is certainly the combination of employee competences with the intellectual capital of a given organization, which is gradually becoming the main, although not material, asset. In this context we cannot omit the notion of knowledge management, because permanent development of an employee contributes to his even greater usefulness for the organization and indirectly to the improvement of the quality (efficiency in the use) of intellectual capital. Without this development we cannot talk about increasing the usefulness of competences for the realization of strategic goals set by the organization and building a permanent competitive advantage on the market. This may become a big barrier in the face of the new era of economy and high uncertainty in the labor market. Of course, we can, as now, force employees to adjust (update) their competences to changing conditions. However, this will be difficult to achieve in the new conditions of the fourth industrial revolution.

On the other hand, as the author wrote at the beginning, competence is a variable and very dynamic term, which is constantly evaluated by companies due to the changing demand for it. Therefore, it is difficult to create a full and, what is important, permanent and complete list of competences (some researchers of the subject mention as many as 300 competences). That is why we have to make a partial categorization of this concept (Rostowski, 2004, pp. 78-79):

- 1) Competences related to abilities – concern the potential of employees, development opportunities, use of abilities to acquire new competences.
- 2) Competences related to skills and abilities – are essential for success in a specific task. These competences include: communicative, mental, interpersonal, technical, business, organizational, etc.
- 3) Knowledge-related competencies – a group of competencies needed to perform specific tasks within a profession or position.
- 4) Physical competence – a set of all competences related to the physical requirements of the workplace, i.e.: physical fitness, sensory awareness, psychophysical abilities.
- 5) Action style competence – refers to the way goals are set, planning skills and organizational skills.
- 6) Personality related competencies – these are complex skills that determine the effectiveness of dealing with a particular type of social situation. These competencies result from personality traits and influence the quality and manner of performing tasks.
- 7) Competences related to principles and values – refer to values, beliefs, principles.
- 8) Competences related to interests – these are competences that indicate preferences for tasks, type of work and working environment. They influence the effectiveness of work, especially when the type of work is fully compatible with the type of interests.

The American defines the key competencies of employees differently from the company perspective. The authors do not focus primarily on knowledge, skills and attitudes. They claim that competence is a permanent set of character traits, value system and mental needs. The employer does not look for personal qualities in an employee that fit a given profession. He is looking for such traits that fit a given field, or even those that simply fit his company. Nowadays, the most important for the employer are skills that do not concern the profession. Social and personal skills are important. The most sought-after qualities have become: self-esteem, self-awareness and self-knowledge – it is the employee who should know what knowledge, skills and experience he has and be able to use this in the labor market. It is also important to remember about the continuous development of one's own skills (Bartkowiak, 2011).

This is strongly linked to the company's strategy, which can be treated as a purposeful and coherent set of actions and decisions that are implemented at a given time. It may also apply to (Matysik, 2016, p. 22):

- an analysis of the current situation and its possible change, if necessary;
- a sequence of decisions within specific time frames;
- the definition of the company's main and long-term objectives and the allocation of resources to achieve these objectives;
- overall planning, which must specify what decisions will be taken in each situation that may occur.

In summary, with this approach to strategy, one can try to list the competences that the key employees of the organization have:

- conceptual skills, i.e. the intellectual potential to understand the general functions of the organization and its environment, to capture the way in which the different parts of the organization come together and to look at the organization itself in a holistic way;
- ability to perceive reality, i.e. to correctly associate phenomena such as social, cultural or political ones;
- diagnostic and analytical skills, i.e. the ability to analyze and diagnose the organization's problems, study their symptoms, develop rational solutions – designing an optimal response in a given situation and choosing a good decision;
- ability to formulate objectives;
- ability to plan creatively – approaching from the final objectives through specific objectives that are properly distributed over time;
- interpersonal skills;
- ability to influence.

3. Research approach

The aim described in the introduction determined the further course and character of the study – the author applied the following set of research methods:

- 1) Analysis of the subject literature – to systematize the language of concepts used in the theory of the subject of the study, that is: key employees, competences and management and determinants of the fourth industrial revolution.
- 2) Interview – structured interviews with senior managers in the surveyed entities – the research was carried out in 2019 in 14 specifically selected large companies, based in Poland – in total 77 people took part in the research. This choice was dictated by the fact that it is the employees working in a given position who have the greatest knowledge of the nature of their work. The employee himself can provide most of the information about the processes in which he is involved, the expectations of the organization, the effects and conditions of his work. Therefore, the basic technique of examining employees may be intelligence, and other techniques provide partial data, cuttings more reliable, they can be confronted with the results of interviews, but it seems that they should be the basic source. They allow obtaining information that is most suitable for the purposes of the study, asking questions about the competences and their use.

On the other hand, it is difficult to find optimal research methods that would be simple enough to induce the respondents to take part in the research, and also allow the consent of the main board of the examined entity. According to the author, the credibility of the collected data was also influenced by the fact that there were no direct questions about the competencies, because in such a case the respondent usually tries to make his or her person look the best.

At the stage of planning the research process, the author intended to use a deliberate and random sample selection based on information about the size of the company from the GUS data for 2018 (3674 business entities meeting the size criterion). Due to limited resources, the author chose the principle of selection on the basis of his own declaration of participation (inquiries were sent to 50 entities whether they were interested in participating in such an undertaking). Unfortunately, the research sample did not reflect the assumed characteristics of the whole group for the country. Therefore, the presented research results cannot be a complete set for Poland – they constitute a basis for expanding the research process in the future, and for now we can only treat them as a pilot study.

In order to determine the competences of key employees and actions taken to manage them in the face of new economic challenges, the author used the inductive and deductive method. Of course, one must agree with

the opinion that these methods are always somewhat subjective, but it is not easy to find a very objective research tool. The inductive method consists in moving from detailed phenomena to general ones, from factors to results, or from causes to effects. Thanks to this, the author has derived global conclusions on the basis of detailed premises, and thus made generalizations. The deductive method, on the other hand, is based on drawing detailed conclusions from general results, moving from effects to causes. The main advantage of combining these two methods is, according to the author of the article, high objectivity of the results and the lack of necessity to separate the influence of all factors on the general phenomenon.

4. Results and discussion

In the first stage of the survey, the respondents assessed the exemplary competences that a key employee should have. A set of these competences (12), was identified and defined in previous research processes (2014-2018) – Figure 2.1, which was devoted to the identification of key employees in companies and the impact of the competence of this group of employees on the construction of competitive advantage of their home organizations. It took place in 14 randomly selected large companies from the maritime industry, based in the Pomeranian Voivodeship – in total, the research was attended by nearly 60 people, representatives of the management. It is worth noting that the author actually managed to identify key employees in the surveyed entities based on the identification of key competences. It is also important that the possession of key competences was no longer the domain of the managerial staff only, but also of various types of specialists. Unfortunately, the research also confirmed that the degree of utilization of the potential of the most important employees for the organization is still at a low level.

Now the author would like to determine the possible degree of changes in this area in relation to previous years and this was to be the starting point for further questions. The questions related to knowledge, skills, personality traits, attitudes and motivation were assessed as: very necessary (assigned score – 3), medium necessary (assigned score – 2), unnecessary (assigned score – 1). Usually for each competence the respondents marked a similar assessment, so the results may not be very different, but they reflect practically the same situation as in previous surveys (Figure 2.2).

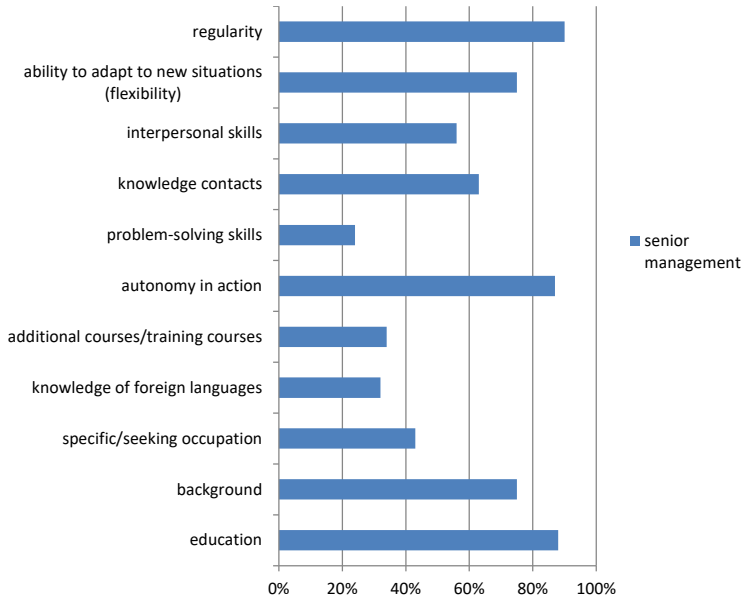


Figure 2.1. Model competencies of key personnel – data from 2014-2018

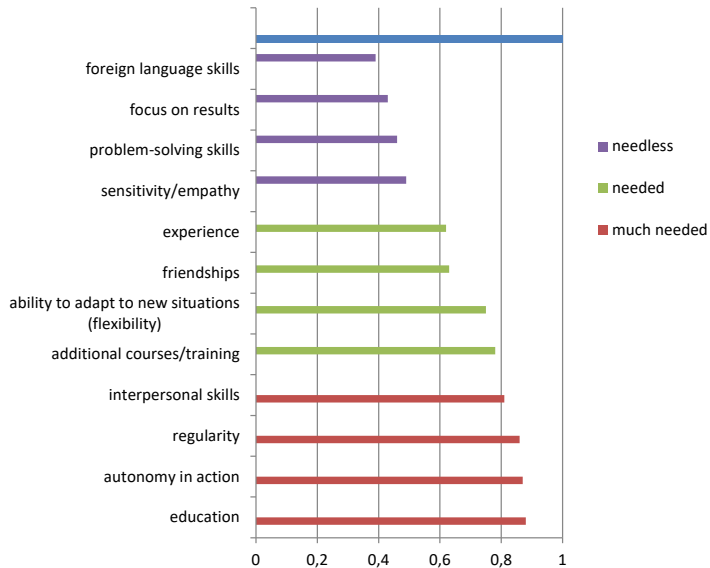


Figure 2.2. Model competencies of key employees

The competences of education, systematic self-reliance, and interpersonal skills were indicated as very important. The fewest indications were given for such competences as: knowledge of foreign languages, ability to solve problems and focus on results. Of course, in some of the respondents' indications one can say that they do not comply with the very definition of competences, but the author did not specifically impose an answer, trying to learn the individual opinion of the respondents. It turned out that the same division is still maintained – very small deviations appeared. The only competence that has definitely lost its importance is the knowledge of foreign languages, which, according to the author, can be interpreted in two ways. On the one hand, we can assume that this has become very common (although another competence – education, still remains at the top of the list) or it may be the result of significant deficiencies in this area in the group of respondents who, knowing their limitations, automatically marginalized this competence.

In the second stage of the research, the author focused on obtaining information from the respondents on the challenges and opportunities that the fourth industrial revolution brings and actions taken to optimally use the competences of key employees in this process. Therefore, bearing in mind that a radical digital transformation is taking place all over the world, the author tried to check how we understand the advanced digital transformation of value chains, products, services, and business models in Polish reality (Figure 2.3).

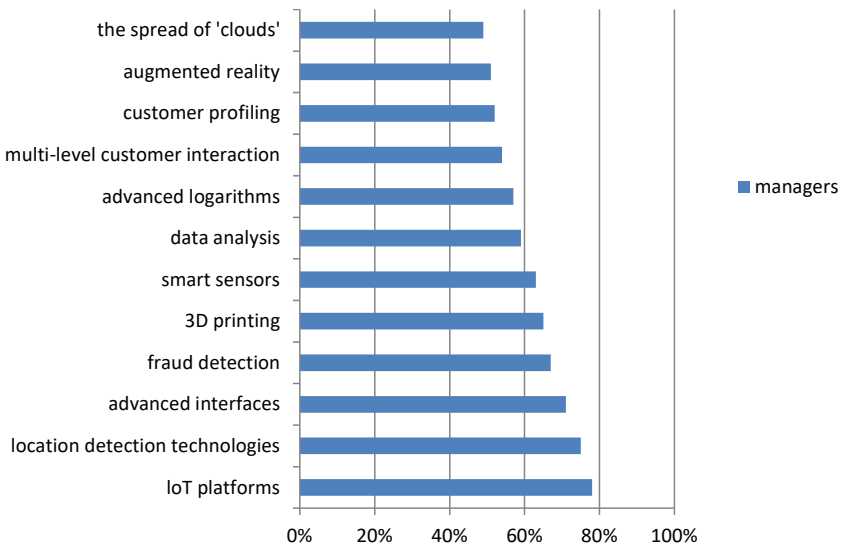


Figure 2.3. To understand the essence of advanced digital transformation

At this point the author wants to point out that contrary to the analysis of the economic situation in Poland and the problems that accompany its development, we may have the impression that we are fully aware of the challenges that stand in our way in connection with the new industrial era. The majority of people who took part in the survey are aware that their companies will be organizations of the digital age, producing physical products and providing innovative services based on data analysis – there will be a radical change in the way they function and the dynamics of processes taking place on the market will also increase. They also know that data and information is the main element of the upcoming changes and they have a long and difficult path ahead of them to achieve advanced analytical capabilities – none of the people participating in the survey declared that they are able to do it in an advanced way, and 90% indicated that their company has significant shortcomings in this respect (Figure 2.4).

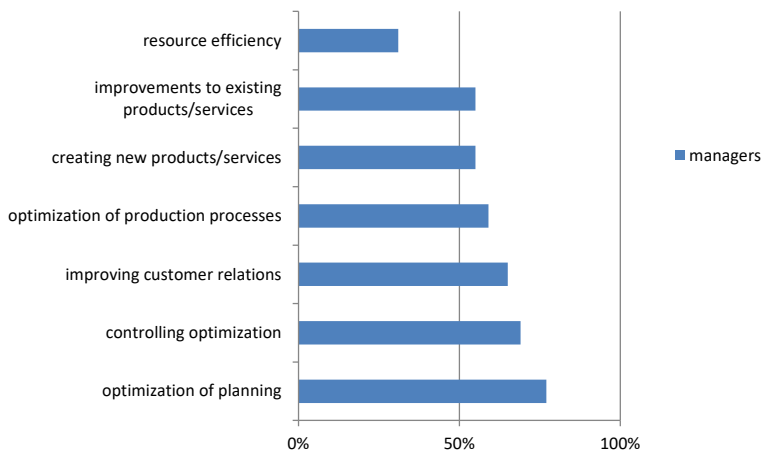


Figure 2.4. Areas that can help the data analyst

Unfortunately, now the author will show more pessimistic data. For a long time now, world leaders have been reshaping the various functions of the internal (vertical) value chain, i.e. optimizing the performance of the various activities that make up the processes using the company's new technologies. As a result, they are able to add more value and expand their offerings by introducing innovative services based on data analysis. Meanwhile, the respondents unanimously stated that no measures are implemented in their enterprises to help them adapt to new conditions. They only indicated what challenges and barriers they see on the way to the new economic reality – Figure 2.5 (each of the research participants could make a maximum of 3 indications).

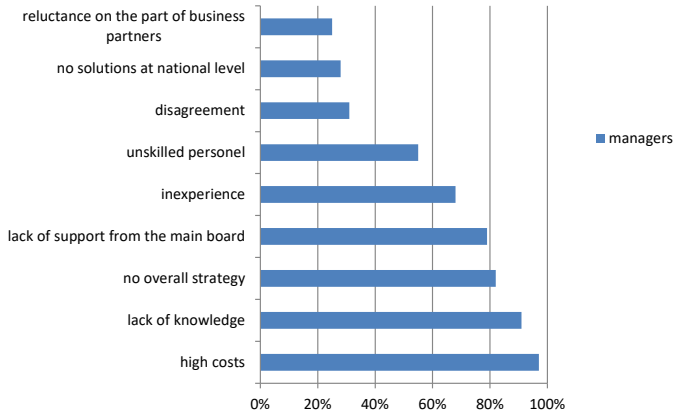


Figure 2.5. The challenges and barriers of the fourth industrial revolution

Obviously, the biggest challenge may be to obtain the necessary financial resources. The problem will also be the lack of support from management boards and a clear vision of what to do next. In many cases, the lack of cooperation with business partners due to organizational and technological immaturity is also a barrier. Unfortunately, the lack of an appropriate organizational culture and the lack of programs for the company’s most important employees will lead to big problems – key employees will leave and it will not be possible to find new people who will be equally talented in their place. What should be the foundation of the new order in the company? It turns out that the management staff in the surveyed entities are well aware of this – Figure 2.6.

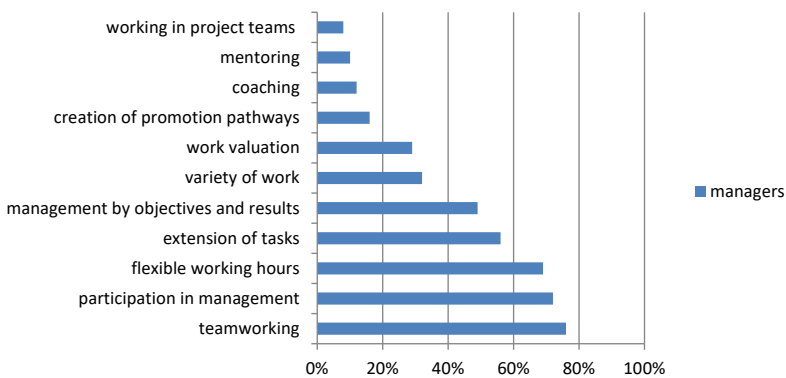


Figure 2.6. Actions that could stimulate key workers in the new economic realities

As we can see from this chart, it is primarily cooperation that does not seem to be taking place in traditional organizational structures, based on functions and divisions. This is certainly often a difficult situation in Polish conditions. Apart from that, with the following questions, most of the respondents pointed to another very big problem in their companies – separate functioning of people responsible for business and separate for technologies. This effectively makes it difficult to take advantage of the opportunities offered by the fourth industrial revolution. Moreover, the respondents emphasized problems with clear leadership in their organizations, leadership, which does not run away from difficult decisions and treats subordinates in a partner way. However, according to the author, the most important thing that became apparent at the very end of the analysis of the survey results was the fact that the vast majority of respondents (nearly 92% of all indications) decided that specific actions had to be taken – you have to define your capabilities and establish strategies of action faster than others, so as not to fall behind. This means that they understand that the key success factor is not just technology itself, but people who can use it effectively. But why don't we do it? Don't we want to make the most of people's potential as a weapon to fight new challenges? Do we not forget about the need for systemic solutions, starting with changes in organizational structures and cultures. These questions are undoubtedly the starting point for identifying innovative tools of human capital management during the fourth industrial revolution.

5. Conclusion

Now we are eyewitnesses of the unprecedented changes taking place in most industries. The third industrial revolution has resulted in the automation of a large number of processes in the company. This has already caused a lot of controversy and forced the implementation of many, often difficult, changes. Now, there is a fourth one that allows for the integration of devices in areas of digital ecosystems. This will increase the integration of value chains, horizontally and vertically. The basis that has enabled, and even led to, the next revolution is the rapid increase in data availability and computing capabilities. This has created the opportunity for better, more efficient management of the entire product life cycle and available company resources.

On the other hand, the greatest value of the company in the 21st century (at least until now) are its employees (especially the key ones), their competences and commitment. On the basis of the analysis of the literature on the subject, the author of the study believes that since competences are derived from skills and knowledge, they can be shaped, raised by means of experience and education. On the other hand, proper, positive motivation, self-confidence and a friendly

working environment build optimal engagement. By putting all this together, you can achieve a kind of success for the organization, measured by many indicators. But a completely different picture emerges from the analysis of the conducted research (so far pilot studies). In all the surveyed entities, despite a fairly high awareness of the effects of future changes and the benefits they may bring, no action is planned. Managers do not create any strategies to help employees adapt to new market conditions, and thus the better use their potential.

Where does this trend come from? Why do passive attitudes dominate in the surveyed entities? One thing is certain – perhaps the awareness of people responsible for the functioning of enterprises is changing, as well as the barriers they have to overcome. However, it is still not an impulse to act. What will be the result? If the situation diagnosed in the companies that took part in the survey illustrates the whole population, then surely the distance between Poland and the richest and most developed countries will not change quickly and will remain constant.

Taking into account all of the collected data, we can state that the assumed research goal has been achieved. What is important, of course, in the author's opinion, just like the development of management sciences, the area of content related to the fourth industrial revolution indicates the importance of this problem, so the enterprises themselves must understand that the driving force behind Industry 4.0 may be an increase in annual revenues, depending on the effective implementation and management of new solutions. This will not be possible without the proper development of the potential of the employees, as it is they who decide on the quality of products, services provided and customer service. They must, therefore, be guaranteed intelligently organized work, adapted to the new conditions, which will undoubtedly allow them to meet a wider range of their needs.

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Biographical note

Michał Igielski (Ph.D.) is a graduate of political science with a specialization in local government at the University of Gdańsk. In addition, he graduated from post-graduate studies on EU Funds and on Human Resources Management. He also finished his doctoral studies at the Faculty of Management at the University of Gdańsk in 2011 with a doctor's degree of economic studies. Since 2006 he has been working at universities where his focus has been on enterprise, project management, and human resources management. At the moment he is working in the Gdynia Maritime University, where he is a coordinator of EU projects, as well as an academic teacher. He has been an adviser to various enterprises in the Baltic Sea Region for nearly ten years.

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The system of organizational terms used for recording managerial activities in the field of team motivation

Olaf Flak¹

Abstract

The aim of the paper is to present an answer to the research question whether the system of organizational terms (an original methodological concept in management science) can be a theoretical foundation to record managerial activities in the field of team motivation. To answer this research question, a non-participating, structured observation was used as a research method. The author was a moderator of this research. A mobile application was used as both a research tool and a time management tool by team managers and team members. As a result of the observation, the use of the system of organizational terms was verified as the theoretical background in recording managerial activities in the field of team motivation. The research results show the possibility of using the system of organizational terms to design mobile applications aimed at team management automation, which could make a significant contribution to management science in the future. In the presented research, two primary organizational terms were recorded: motivation and a motivating plan. The structure and values of their measured units are described in the paper in detail.

Keywords: *motivation, team management, system of organizational terms*

1. Introduction

Since the Internet was invented, there has been a continued and inevitable digitalization and automation of the contemporary world (Haigh, Russell, & Dutton, 2015). On the one hand, it is possible to notice that managers more and more often use online tools that can record their work (Ewenstein, Hancock, & Komm, 2016). On the other hand, there are more and more scientific papers on

¹ Olaf Flak, Ph.D., Hab. (dr hab. inż.), Prof. UŚ, Krzysztof Kieslowski Film School, University of Silesia in Katowice, Bankowa 12, 40-007 Katowice, Poland, e-mail: olaf.flak@us.edu.pl (ORCID ID: 0000-0001-8815-1185).

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replacing human managers with software and, consequently, with machines as managers (Chui, Manyika, & Miremadi, 2015).

It is worth admitting that in 1967 P. Drucker wrote that computer systems (in those years – computers) would not only be used to gather data on some activities, but the algorithms implemented there would also be able to replace human managers' work over time (Drucker, 1967). Although computer systems penetrate and automate more and more human activities, and consequently also managerial work, despite these few decades, it has not happened (Harper, 2020).

In order to make team management possible, it is necessary to solve a research problem, which concerns (1) the types of team management processes and their content (content domain), (2) a sequence of team management processes in reality (time domain), and (3) the psychosocial characteristics of a team manager and his team members, which are connected to particular team management processes (psychosocial domain) (Flak, 2020). In other words, it is necessary to answer the general research question: what does a manager really do? (Sinar & Paese, 2016)

This paper is a part of the long-term research conducted by the author that aims at designing and implementing management tools, which can record a manager's activities in team management. The purpose is to recognize the patterns of behaviors of managers and automate some team management processes. When the author was granted a project to create a mobile application used by managers to motivate their team members, he formulated a particular research question: can the system of organizational terms (an original methodological concept in management science created by the author) be used as a theoretical foundation to record managers' activities in the field of team motivation?

After finishing the project, it was possible to answer this research question. Therefore, the aim of the paper is to present a way of using the system of organizational terms to record a manager's activities in team management and recognize the possibilities in managerial behavior automation, which in the future could lead to replacing a human manager with a robot. It should be emphasized that this paper is a research report on using this methodological concept. It is not aimed at any contribution to any research problems in organizational reality, including team motivation.

The research method that was used in the phase of searching for an answer to the research question was a structured non-participant observation, where the author of the paper played the role of a moderator. The mobile application was a research tool as well as a management tool installed by users (Flak, 2017). The management tool is called Team Motivator and it was used to examine team members' motivation, and plan motivating activities

by a manager. The research was conducted in the period from 27.01.2020 to 10.02.2020. Five teams of employees took part in the research as well as one student group during the management techniques course (a subject in the first year of their masters' studies, "Film and television production" at Krzysztof Kieslowski Film School, the University of Silesia in Katowice). Because of the limited length of this paper, only parts of the research results of one of the employees' teams are described. Research results on the other teams taking part in the research were achieved in the same way and the only differences are the measured values.

Section 2 details the main characteristics of the system of organizational terms and theoretical foundations of concepts, which were operationalized and measured, particularly concepts of motivation and a motivation plan. Section 3e presents both of these concepts as two primal organizational terms, used to design the mobile application, Team Motivator, and recorded by this application in real-time. There is also a description of the application's functions and a procedure for using it. Additionally, there is a plan of the conducted research. Section 4 gives the results of the empirical research on managerial activities in the field of team motivation focused on one of the team members as an example. In Section 5, there are conclusions drawn from the research and the perspectives of the authors' scientific aims.

2. Literature background

As the next part of the description of using management processes automation, it is possible to show examples of many research studies concerning attempts at automation in many different areas of company management. There are attempts in logistics processes in the value chain in a company (Dash, McMurtrey, & Rebman, 2019), services in the IT sector for their own clients (Keller, 2017) as well as team management automation (Davenport & Kirby, 2015; Filder, 2015). The last area of automation seems so universal that it is an important element in any organizational management automation.

Taking into consideration what was written above, it is possible to ask the question:

RQ: Why can we not employ a robot in a managerial position at the beginning of the third decade of the 20th century?

Although the answer to this question is not so easy, in order to make it possible, several conditions should be met:

- it should be possible to predict the behavior of managers and team members (Klein, 2005);

- the possibility of a real influence of such an artificial manager on team members should exist (Christoffersen & Woods, 2002);
- there should be a mutual basis for communication for an artificial manager and team members, which means shared concepts and their meanings (Clark & Brennan, 1991).

The first condition concerns an analysis of the behavioral patterns of human managers and team members. From the perspective of existing pattern recognition techniques, this is not a novel and important scientific problem (Theodoridis & Koutroumbas, 2008; Flak, Yang, & Grzegorzec, 2017). The second condition describes some kind of physical and psychological interdependence of an artificial manager and its team members. This aspect needs to be thoroughly explored by scientists because it is a different source of managerial authority compared with a common pattern of a human manager and a human team member (Kocak, 2019). The third condition mentioned above was a core of the design of the methodological concept called the system of organizational terms (Flak, 2018), which is to play a similar role in organizational reality research to the International System of Units (SI) in physical action automation (Goebel, Mills, & Wallard, 2006).

The system of organizational terms is a holistic, coherent, and formalized methodological concept in management science, which allows for studying organizational reality, to a large extent overcoming most present methodological problems in management science. Firstly, the concept is holistic, which means it covers with its assumptions most scientific areas and constructs such as ontological and epistemological assumptions, use of a language, reasoning methods, etc. Secondly, the system of organizational terms is coherent, so it is internally consistent and complementary. Thirdly, the concept is formalized, which means that there are strictly defined rules on how to use particular elements of science. The rules are either general or particular, as well as described in a universal and scalable way (Flak, 2018).

Historical inspiration for designing the system of organizational terms and the recording methods of the organizational terms came from a study conducted by the Gilbreths, who tried to classify the rudimentary movements of workers by the use of a cycle graph (Peszko, 2002). Furthermore, the classical method of work time research was taken into consideration (Bieniok, 2001). In the system of organizational terms, a process in an organization (Brajner-Marczak, 2016) is represented by an event, and a resource in an organization (Barney, 1991) is represented as a thing. Both events and things are the facts that appear in organizational reality (Wittgenstein, 2000). This organizational reality also consists of manager's activities. The facts can be presented by an organizational term, which is a symbolic object and an element that belongs to organizational reality model (Rios, 2013). The organizational

terms do not exist in organizational reality. They are only abstracts, they exist in a language and they are used to store information about a certain fact (Frankfort-Nachmias & Nachmias, 2001). When the organizational term appears, it can change in a function of time in a qualitative, quantitative, mereological, and substantial way (Gryganiec, 2011).

From the ontological point of view of organizational reality, the organizational terms can be logically divided into two classes: primal organizational terms and derivative organizational terms (Przybyłowski, 1999). The primal organizational terms are the symbols of facts in the class of things (resources in an organization) and the derivative organizational terms are the symbols of facts in the class of events (processes in an organization). Therefore, the system of organizational terms combines both the research approach and the process approach in management science. The next logical division of organizational terms, both the primary and derivative ones, gives types of organizational terms. The number of types is not limited.

As far as team management is concerned, in the system of organizational terms, a managerial action is represented by a pair of a thing and an event (Flak, Yang, & Grzegorzek, 2017), which are a primary and derivative organizational term, respectively. In the general notation, a thing or an event is called $n.m$, where n means a number of a thing or an event, and m is their version. This approach enables representing managerial actions in a function of time in a way presented by the example of common managerial actions in Figure 2.7.

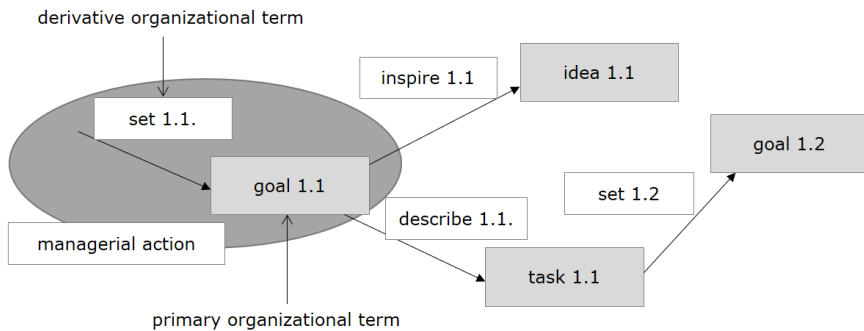


Figure 2.7. An example of a managerial action structure in the system of organizational terms

For example, in Figure 2.7, the managerial action consists of an event “set 1.1” and a thing “goal 1.1.,” which means that a manager started a process to achieve a resource – in this case, he started setting a goal (an organizational

resource). Next, there was an event “inspire 1.1” and as a result of this, a thing “idea 1.1” appeared (for example, in the head of a team member). Meanwhile, a manager could start an event “describe 1.1,” which resulted in a thing called “task 1.1.” Then, a manager again started an event “set” in the second version (set 1.2), which results in the second version of the thing “goal 1.2.” This approach makes it possible to use pattern recognition techniques, and by doing so, to estimate the similarity of team management (Yang, Flak, & Grzegorzek, 2018).

The system of organizational terms as a methodological concept also consists of foundations of designing research tools that could be used to record organizational terms appearing in organizational reality. The research tool records information only on a certain primary organizational term (a resource in an organization in the resource approach) and it is also a management tool that is used by a manager in team management (Chopraa & Gopal, 2011, Kanji, 2002). The research tool is an instrument based on a concept of behavioural unit (Chopraa, & Gopal, 2011). In Figure 2.7, the primary organizational terms, whose features are recorded by the research tool, are grey.

In the author’s previous research, online management tools were used to verify the system of organizational terms. The online management tools were implemented as the Internet platform TransistorsHead.com, available through a browser (Flak, Hoffmann-Burdzińska, & Yang, 2018; Alnajjar & Flak, 2016). However, in the above-mentioned project, which was given to the author as a part of the “Inkubator Innowacyjności 2.0” program, there was a possibility to design a mobile application aimed at (1) examining team members’ motivation and (2) planning motivating activities by a manager. That seemed a good moment to test the system of organizational terms as the theoretical foundation in this area. The project team, which consisted of the author and Dr. Adrian Pyszka (from the University of Silesia in Katowice), chose two primal organizational terms, which became a base for the functionality of the mobile application. The primal organizational terms were motivation and a motivating plan.

The project team faced the dilemma of choosing a theory of motivation. Theories of motivation have been developing rapidly since the first scientific experiments concerning the influence of motivating factors on work efficiency conducted in a manufacturing company in Hawthorne in 1927 by Elton Mayo (Szatyńska, 1972). The next important contribution to the theories of motivation was Abraham Maslow’s paper entitled “Motivation and Personality.” His theory of motivation was based on the hierarchy of needs and it influenced the next generations of researchers in psychology and management science (Lussier, 2019). Launched at the same time were other theories of motivation in the perspective of the so-called theories of content, such as Herzberg’s motivation-hygiene theory and dual-factor theory (Herzberg, 1959; Farr,

1977) and X-Y theory (McGregor, 1960). Another approach to motivation was the so-called theories of process (today, it would be better to describe them as theories of motivation), such as the expectancy theory (Vroom, 1964) and the reinforcement theory (Skinner, 1959).

On the one hand, since that time, many new approaches to human motivation have appeared. On the other hand, these old theories still seem to be used by researchers in social sciences, with the most significant seeming to be Maslow's hierarchy of needs, which is confirmed by many up-to-date studies on motivation (Stefan, Popa, & Albu, 2020; Poirier & Devraj, 2019; Lonn & Dantzler, 2017). Therefore, Maslow's hierarchy of needs was chosen to define the first primary organizational need, which is motivation.

The second primary organizational term, which was used as a theoretical foundation during the designing process of the mobile application, was a motivating plan. From the perspective of managerial activities targeted at meeting the needs of team members, the managerial action aimed at this can be placed in the area of process motivation theories (Ferster & Skinner, 1957; Enckell, 2007). Therefore, a motivating plan is a logical concept whose frames consist of features of a plan and the content is a process motivation theory. In this approach, elements of this concept are the same as in any other plan – content of a task, a task deadline, and task doers (Atkinson, 1999; Mantel, Meredith, Shafer, & Sutton, 2001).

Both primary organizational terms – motivation and a motivating plan – were used as a theoretical foundation in the design of screens of the mobile application. The screens were also the research tools measuring these primary organizational terms in the practice of team management. Detailed characteristics of the organizational terms dimensions and their measured units (Flak, 2010) are described in Section 3.

3. Research approach and methods

The empirical research, which aimed at answering the research question whether the system of organizational terms can be used as a theoretical background to record managers' activities in the field of team motivation, was conducted in the period from 27.01.2020 to 10.02.2020. Five employee teams and one student team took part in the research. The student team was studying the management techniques course (a subject in the first year of the masters' studies "Film and television production" at Krzysztof Kieslowski Film School, the University of Silesia in Katowice).

The research method aimed at looking for the research question was a non-participant, structured observation together with the mobile application,

Team Motivator, as a research tool. Team Motivator was, at the same time, a management tool. The author of the paper was a moderator of the research.

Table 2.12. Dimensions, measured unit and a measuring scale – motivation

Dimension of the primary organizational term	Measured unit	Measuring scale
Check-up	Name of a check-up	Nominal scale (string of characters)
Period of a motivation diagnosis	Start day End day	Nominal scale (date)
Team member	Name of a team member	Nominal scale (string of characters)
Needs	Need 1: Up-to-now achievements Need 2: Skills and knowledge development Need 3: Responsibility for your life Need 4: Promotion Need 5: Regard Need 6: Prestige Need 7: Interaction with other people Need 8: Friendship Need 9: Love Need 10: Social security Need 11: Health and mental condition Need 12: Physical security Need 13: Shelter Need 14: Hunger Need 15: Sleep	Ordinal scale (from 0 to 5)
Proposed motivators	Motivator 1: Up-to-now achievements Motivator 2: Skills and knowledge development Motivator 3: Responsibility for your life Motivator 4: Promotion Motivator 5: Regard Motivator 6: Prestige Motivator 7: Interaction with other people Motivator 8: Friendship Motivator 9: Love Motivator 10: Social security Motivator 11: Health and mental condition Motivator 12: Physical security Motivator 13: Shelter Motivator 14: Hunger Motivator 15: Sleep	Nominal scale (string of characters)

The participants of the observation received a detailed plan of the observation, which included a quintuple measurement of two primary organizational terms (motivation and a motivating plan), instructions on how to use the Motivation Tools, and a detailed timetable of the measurement. In the paper, two measures of both primary organizational terms are presented, coming one after another of one person belonging to one of the employee teams and his team manager.

As was explained above, there were two primary organizational terms examined in the measurement, motivation, and a motivating plan. Both primary organizational terms were described by measured units, which were grouped in dimensions of organizational terms (Flak, 2010). In Table 2.12, there are dimensions of the primary organizational terms called motivation, its measured units, and types of a scale of measured units. By the same token, in Table 2.13 there are dimensions of the primary organizational terms called a motivating plan, its measured units, and types of a scale of measured units. As far as the primary organizational term called a motivating plan is concerned, it was assumed that this organizational term contains a countless number of dimensions called a motivation action. These dimensions are numbered from 1 to n.

Table 2.13. Dimensions, measured unit and a measuring scale – a motivating plan

Dimension of the primary organizational term	Measured unit	Measuring scale
Check-up	Name of a check-up	Nominal scale (string of characters)
Period of a motivating plan	Start day End day	Nominal scale (date)
Team manager	Name of a team manager	Nominal scale (string of characters)
Motivating action n	Start day	Nominal scale (date)
	End day	Nominal scale (date)
	Type of a motivating action	Nominal scale (individual, team)
	Content of a motivating action	Nominal scale (string of characters)

The mobile application, Team Motivator, was used as a measuring tool to record both primary organizational terms. From a functional point of view, Team Motivator can be installed on a mobile device with an Android or IOS operating system. It consists of a few modules such as a login module, a team-

motivation diagnosis module, a motivating plan module, a motivating actions monitor module, a module of team managers' behavior pattern recognition, and a module of team members' behavior pattern recognition.

The mobile application is a quite complex computer program that has the following special features. Firstly, the application allows a team manager to solve a sophisticated organizational problem (Jerzak, 1994). From the team management perspective, this problem consists of team-motivation diagnosis and a plan of motivating action at a certain time, which are an answer to the diagnosed motivation. Secondly, every user of the application can be in one of two roles – either a team manager or team member – in any number of teams at the same time. This solution is very flexible because once installed on a mobile device, the application makes it possible to either create a team and invite other team members who also have it installed or be invited to an existing team by any other user of the application. The number of teams and users belonging to the team is not limited.

Thirdly, the application does not store any data in the mobile device's memory. All the data are recorded in a database on a server, which makes it possible to use the application on different devices at the same time by the same user, create the next versions of the application and install them on a mobile without losing data gathered before. Finally, the application does not use any hardware components of a mobile device, such as a microphone, a camera) or any other installed applications, which makes Team Motivator very safe to use.

Due to the fact that the application helps a team manager to solve an organizational problem of both a motivation diagnosis and a motivating plan, Team Motivator consists of two parts:

- Motivation test – a diagnostic tool that uses the first primary organizational term – motivation – as a theoretical foundation (Table 2.12). A questionnaire with closed-end questions concerning Maslow's hierarchy of needs and open-end questions about proposed motivators that could meet these needs is a measuring tool;
- Motivating plan – a planning tool that uses the first primary organizational term – motivation – as a theoretical foundation (Table 2.13). A calendar was used as a planning tool because such a form is quite popular in mobile applications for time management. This calendar was embedded with a dedicated module of a motivating action description for a particular team member or all team members together.

A motivation test and a motivating plan are parts of a check-up, a diagnostic-planning unit, which is created by a team manager for a certain period of time.

In Figure 2.8, there are three screenshots of the application, which from the left show (1) a user manual with a procedure of using the application in order to solve an organizational problem, (2) an application menu after logging in and creating a team, and (3) a list of five check-ups for this team, including the fifth one, which is ready to edit.

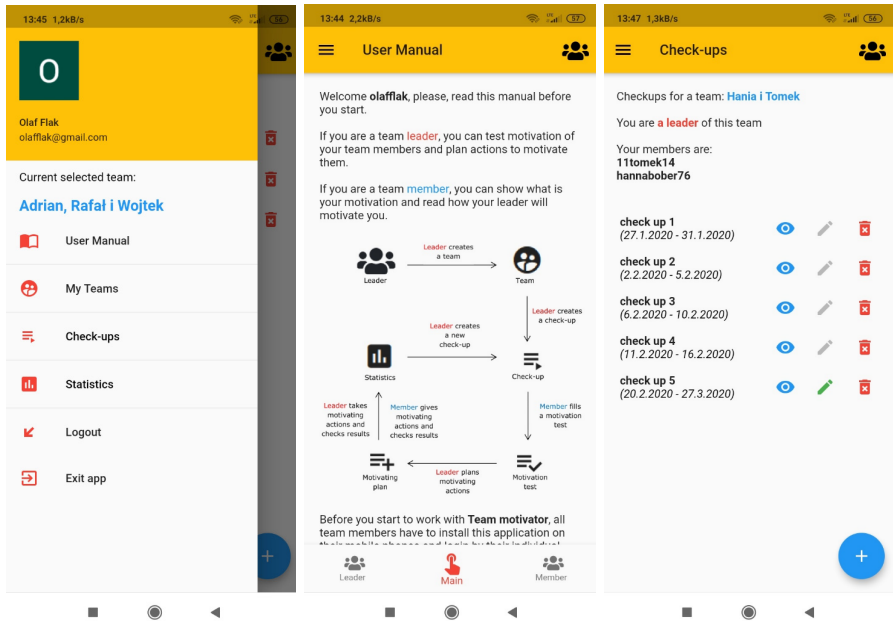


Figure 2.8. Application screenshots of (1) a user manual, (2) a main menu and (3) a list of check-ups

It should be emphasized that the diagnostic-planning unit – a check-up – is a basic object created by a team manager and it has a unique name and a certain period. The check-up consists of two subperiods: a motivation diagnosis period (primary organizational term – motivation) and a motivating plan period (primary organizational term – a motivating plan). This object-oriented approach allows a team manager to take managerial actions in a sequence of time, and analyze a decrease or an increase in team motivation as a result of a motivating plan, etc.

In Figure 2.9, we can see (1) a part of a screenshot of the Motivation test (for the primary organizational term called motivation) in the diagnostic-planning unit called “check-up 5,” which is to be filled in by the team members. As can be seen in Figure 2.9, the team members in the period from 20.02.2020 to 27.02.2020 were asked to answer the question: “What do you need now?” with respect to 15 needs in Maslow’s hierarchy of needs (in Figure 2.9, there are only two highest needs and the rest of the needs were available after scrolling down the screen). A team manager was able to turn the forms on and off. Team members could propose their best motivator (proposals of motivators), edit the name of the check-up (short name of the check-up), and set a period within

which the motivation test was valid (period of motivation test in this check-up) as well as edit the names of all the needs in Maslow's hierarchy.

Figure 2.9 also presents (2) a screenshot of a motivating plan for all team members (all members) in the period from 28.02.2020 to 27.03.2020. After clicking on a certain date, it is possible to create a motivating action for a single member or the whole team. This view is also available for team members.

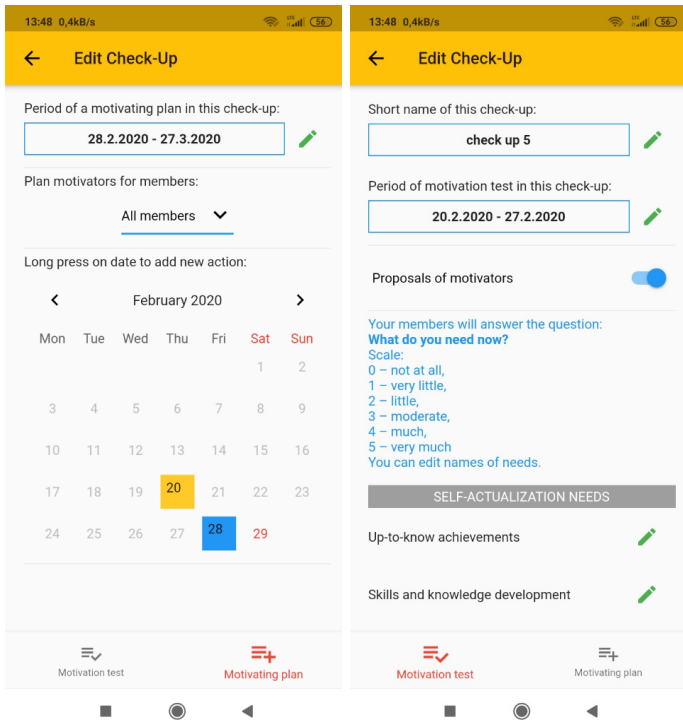


Figure 2.9. Application screenshots of (1) the motivation test and (2) the motivating plan

It is worth underlining that a team manager can edit any motivating actions in the motivating plan and a team member can see only those motivating actions that were planned by the manager for him. An opinion about the effects of these motivating actions can be expressed by a team member, not directly, but in the next motivation diagnosis in the next check-up. Then a team member assesses to what extent his needs were satisfied in the previous check-up and can write an appropriate proposal of motivators. This way, the data gathered in the following check-ups allows for the analysis of the behavior of a team manager and team members.

Every diagnostic-planning unit (a check-up) has another part as an analysis of the team manager and team members' activities in the field of team motivation, which is available in the statistics menu. This function in the application consists of two screens: the motivation test and the motivating plan. The statistics menu allows a user to distinguish a class of team member depending on the kind of needs that motivate him. There are three classes of team member after the motivation diagnosis: a basic-needs player, a social-needs player, a sophisticated-needs player. A team manager is also assessed in the application, depending on how he motivated a certain team member. A team manager can belong to one of four classes: focused and efficient, unfocused and efficient, focused and inefficient, unfocused, and inefficient. These classes are determined depending on the matching of motivational activities to the needs of a team member and the effect, i.e. whether these needs were met.

4. Results and discussion

As was mentioned in Section 3, the research consisted of five samples of both primary organizational terms measurement in every team. Taking into consideration the length of this paper, there are two measurements for both primary organizational terms of one member of one team and his team manager. The rest of the measurements for this team and the other teams were conducted in the same way and the results differ from each other only in terms of measured unit values.

Table 2.14 shows the results of the first measurement of the primary organizational term called motivation for a team member, and Table 2.15 contains a motivating plan made by a team manager for this team member after a motivation diagnosis of this team member.

It should be emphasized that some of the needs presented in Table 2.14 were not felt by this team member (their values of measured units were 0) and that this team member did not make any proposal of motivators to his team manager. In Table 2.15, however, there are two motivating actions planned by the team manager as an answer to the needs of the team member.

Table 2.14. Results of the first measurement of the primary organizational term called motivation

Dimension of the primary organizational term	Measured unit	Measuring scale
Check-up	Name of a check-up	check up 1
Period of a motivation diagnosis	Start day	27.01.2020
	End day	28.01.2020
Team member	Name of a team member	Hanna
Needs	Need 1: Up-to-now achievements	3
	Need 2: Skills and knowledge development	4
	Need 3: Responsibility for your life	0
	Need 4: Promotion	0
	Need 5: Regard	0
	Need 6: Prestige	0
	Need 7: Interaction with other people	3
	Need 8: Friendship	3
	Need 9: Love	3
	Need 10: Social security	0
	Need 11: Health and mental condition	4
	Need 12: Physical security	0
	Need 13: Shelter	0
	Need 14: Hunger	3
	Need 15: Sleep	3
Proposed motivators	Motivator 1: Up-to-now achievements	-
	Motivator 2: Skills and knowledge development	-
	Motivator 3: Responsibility for your life	-
	Motivator 4: Promotion	-
	Motivator 5: Regard	-
	Motivator 6: Prestige	-
	Motivator 7: Interaction with other people	-
	Motivator 8: Friendship	-
	Motivator 9: Love	-
	Motivator 10: Social security	-
	Motivator 11: Health and mental condition	-
	Motivator 12: Physical security	-
	Motivator 13: Shelter	-
	Motivator 14: Hunger	-
	Motivator 15: Sleep	-

Table 2.15. Results of the first measurement of the primary organizational term called a motivating plan

Dimension of the primary organizational term	Measured unit	Measuring scale
Check-up	Name of a check-up	check up 1
Period of a motivating plan	Start day	29.01.2020
	End day	31.01.2020
Team manager	Name of a team manager	Piotr
Motivating action 1	Start day	29.01.2020
	End day	29.01.2020
	Type of a motivating action	individual
	Content of a motivating action	Go home earlier – about 2.00 pm
Motivating action 2	Start day	31.01.2020
	End day	31.01.2020
	Type of a motivating action	individual
	Content of a motivating action	We have to talk about your promotion – tomorrow at 9.00 am

After the period of the first diagnostic-planning unit called “check-up 1” (27.01.2020 to 31.01.2020), a team manager created again the second diagnostic-planning unit called “check-up 1,” which was planned from 02.02.2020 to 05.02.2020. Table 2.16 presents the results of the second measurement of the primary organizational term called motivation for the same team member, while in Table 2.17, there is a motivating plan made by the team manager for this team member as a response to the motivation diagnosis.

In Table 2.16, it can be seen that the extent to which the needs of this team member were met is different from the one examined before and shown in Table 2.14. In this case, the team member again did not propose any motivators. In response to the second motivation diagnosis (a primary organizational term called motivation in Table 2.16), there is a motivating plan (Table 2.17) made by the team manager. This motivating plan consists of only one motivating action.

Table 2.16. Results of the second measurement of the primary organizational term called motivation

Dimension of the primary organizational term	Measured unit	Measuring scale
Check-up	Name of a check-up	check up 2
Period of a motivation diagnosis	Start day	02.02.2020
	End day	03.02.2020
Team member	Name of a team member	Hanna
Needs	Need 1: Up-to-now achievements	4
	Need 2: Skills and knowledge development	4
	Need 3: Responsibility for your life	3
	Need 4: Promotion	0
	Need 5: Regard	0
	Need 6: Prestige	1
	Need 7: Interaction with other people	1
	Need 8: Friendship	4
	Need 9: Love	4
	Need 10: Social security	1
	Need 11: Health and mental condition	5
	Need 12: Physical security	0
	Need 13: Shelter	0
	Need 14: Hunger	3
	Need 15: Sleep	3
Proposed motivators	Motivator 1: Up-to-now achievements	-
	Motivator 2: Skills and knowledge development	-
	Motivator 3: Responsibility for your life	-
	Motivator 4: Promotion	-
	Motivator 5: Regard	-
	Motivator 6: Prestige	-
	Motivator 7: Interaction with other people	-
	Motivator 8: Friendship	-
	Motivator 9: Love	-
	Motivator 10: Social security	-
	Motivator 11: Health and mental condition	-
	Motivator 12: Physical security	-
	Motivator 13: Shelter	-
	Motivator 14: Hunger	-
	Motivator 15: Sleep	-

In Figure 2.10, there is a chronological sequence of organizational terms that occurred in organizational reality. With the use of the mobile application, Team Motivator, the following primary organizational terms were measured: motivation 1.1. (Table 2.14), a motivating plan 1.1 (Table 2.15), motivation 1.2 (Table 2.16), a motivation plan 1.2 (Table 2.17).

Table 2.17. Results of the second measurement of the primary organizational term called a motivating plan

Dimension of the primary organizational term	Measured unit	Measuring scale
Check up	Name of a check up	check up 1
Period of a motivating plan	Start day	04.02.2020
	End day	05.02.2020
Team manager	Name of a team manager	Piotr
Motivating action 1	Start day	05.02.2020
	End day	05.02.2020
	Type of a motivating action	individual
	Content of a motivating action	Go skiing after lunch

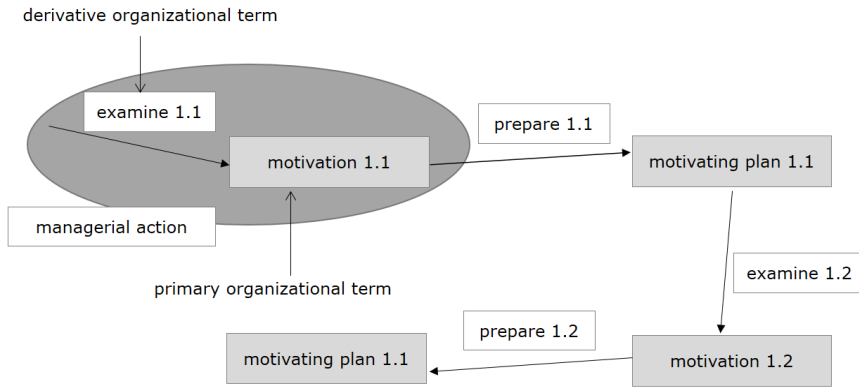


Figure 2.10. Real structure of managerial actions in the field of team motivation

Figure 2.10 displays the organizational terms that occurred in the field of team management of a given team, which show the real sequence of this process in the function of time. This is in keeping with the assumptions of the system of organizational terms as a methodological concept in management science, which was shown in Figure 2.7 and described in Section 2. It is necessary to underline that the measurement concerned only primary organizational terms (which was the fact of the class, in other words – the resources in an organizational approach). As for derivative organizational terms (which was the fact of the event class, in other words – the processes in an organizational approach), it is possible to infer their occurrence on the basis of the fact that the primary organizational terms occurred (Flak, 2018).

5. Conclusions

The results of the research on the Team Motivator users are the basis for a few conclusions. Firstly, the system of organizational terms as a methodological concept in management science can be a theoretical foundation for recording managers' activities in the field of team management. The research has proven such a possibility. The recorded primary organizational terms – motivation and a motivating plan – make it possible to represent the managers' activities and the team members' activities in the function of time, which was presented in Figure 2.10.

All the recorded primary organizational terms can be described by the measured units presented in Tables 2.14, 2.15, 2.16, 2.17. Changes in these measured units also allow making conclusions on derivative organizational terms (examine and prepare, respectively, to motivation and a motivating plan), which appeared in organizational reality during team management. It should be emphasized that it was the first time when the system of organizational terms was used to record managerial activities in the field of team motivation by a mobile application. In the author's previous research (Flak, Hoffmann-Burdzińska, & Yang, 2018; Flak, Yang, & Grzegorzec, 2017), the system of organizational terms was used to design online management tools available by an Internet browser.

Secondly, despite the fact that in Section 4, the results of only two measurements for primary organizational terms of one team manager and one team member were described, it is worth underlining that in the period from 27.01.2020 to 10.02.2020, 12 primary organizational terms called motivation were recorded as well as 12 primary organizational terms called a motivating plan. These results allow conclusions to be drawn on the number and sequence of the organizational terms, and on the meaning of them. This is possible thanks to the measured units, which recorded phenomena on a nominal scale as a string of characters. However, the analysis of these correlations, for example, which motivating action satisfied a particular need, is far beyond human perception. In order to draw such conclusions, it would be necessary to use machine learning and pattern recognition techniques. This would make the introduction of team management automation possible to a greater extent. However, it would need a much larger amount of data gathered by the mobile application, Team Motivator, coming from a long time of using this tool by the team manager and his team members.

Thirdly, in reference to the above-mentioned challenge and taking into consideration the main aim of the author's scientific efforts, which is team management automation, it is necessary to design and implement the n number of similar mobile applications. This would be useful in solving day-to-day

organizational problems in a company and would be used by team managers and their team members. At the same time, these management tools will be based on the m number of primary organizational terms. As this paper was being finished, another mobile application was about to be completed. Its theoretical foundation was a primary organizational term called decision.

We can assume that a team manager and his team working with the n number of mobile applications of this kind enables doing the k number of measurements of the m number of primary organizational terms in the function of time. The k -parameter depends on the frequency of using every one of these mobile applications by the team managers and their team members.

The results of the research described in the paper suggest that data gathered in this way will allow the recognition of (1) the types of team management process (content domain), (2) a sequence of these team management processes (time domain), and (3) the psychosocial characteristics of a team manager and his team members corresponding to particular team management processes (psychosocial domain) (Flak, 2020). It will allow building knowledge on the managerial activities, which would make it possible to use certain strategies of imitating human managers (Breazeal, 2003) and replacing them in certain situations with robots.

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Biographical note

Olaf Flak graduated in Management from the University of Economics in Katowice, and Electronics from the Silesian University of Technology in Gliwice, Poland. He got a Ph.D. in Economy in 2006, and in 2019, he got a degree of habilitation in Management Science. He is a Deputy Dean for International Affairs and Organization at the Radio and Television Faculty – University of Silesia and an Associate Professor at the University of Silesia. From 2002–2010, he was an Assistant Professor at the University of Economics in Katowice in the Faculty of Management. He is a scientist and a specialist in business management, a trainer, and a business consultant. His research area is investigating how automatic pattern recognition techniques can be applied in the management of science. He has managed several

projects concerning the detection of actions taken by managers and their subordinates in an organization, using online management tools that record information about actions as numeric data. The scientific and practical goal of such pattern recognition is to recognize patterns of users' actions, and finally, generating automatically some prompts and advice for users. In the future, he wants to create an artificial manager, which could conduct some operations in team management. He is an author for the online management tool TransistorsHead.com, the research platform Sensorium24.com and a few blogs on the management website Konsultanci24.pl.

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Lean management as a method for improving selected processes at hotels

Małgorzata Sztorc¹

Abstract

The article discusses the recognition of lean management tools that are used to improve processes by hotel companies on the Polish market. The research problem was formulated in the form of the following questions: 1. What lean management tools are used to improve selected customer service processes in hotel enterprises? and 2. What are the reasons for using lean management tools in the process of guest service and service provision in hotels? Concerning the research questions posed, the article aimed to identify lean management tools enabling the improvement of processes related to guest service and the provision of services by hotel enterprises. In connection with the set goal, the method of reporting analysis and critical evaluation of the literature on the subject was used, as well as the presentation of the current state of knowledge in the field of the studied problem. The method of a diagnostic survey carried out using the survey technique CAWI (Computer Assisted Web Interview) was also used. The survey was carried out among 421 hotel representatives. The method of statistical analysis of the obtained data using the Statistica package was used to interpret the results. Research results indicate that hotels usually use lean management tools to increase efficiency, standardize the process of providing services, attract new guests, improve the quality of service, and the process of providing services. Hotels, depending on the category, use typical lean management tools to improve the implementation of these processes. The issues presented in the article are an attempt to fill the gap indicating practical experience related to the use of lean management tools in the hotel sector and present their usefulness in improving guest service processes and hotel services.

Keywords: *lean management, waste, value stream, the hotel industry*

¹ Małgorzata Sztorc, Ph.D., Assistant Professor, Adjunct, Department of Management and Marketing, Kielce University of Technology, al. Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland, e-mail: msztorc@tu.kielce.pl (ORCID ID: 0000-0003-0881-0844).

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1. Introduction

Currently operating hotel enterprises, engaging in a competitive struggle in the global market, usually modify the procedures in the field of organization methods, functioning, service provision process, cost analysis, and organizational culture. Today's hotel enterprises are entities operating in the services sector that deliver their products directly to hotel guests (buyers). They differ from production companies by the direct contact of hoteliers with the service buyers. A hotel enterprise is a system composed of resources (human, capital, information, material), as well as processes occurring in these resources, created to conduct business activity, consisting in the provision of hotel services (Lichtarski, 2015). The changes taking place under the influence of the globalization process on the hotel market impose the necessity of continuous improvement of processes taking place in the chain of creating value for the buyer. Improvement from a lean management perspective will be understood in this study as raising the standards of hotel guest service and service provision. The improvement process can be classified from the lean management tool called kaizen and innovation. Kaizen means constant small improvements to the existing state by introducing continuous changes without violent interference in the functioning of the company. On the other hand, improvement through innovation means a radical improvement of the existing condition through significant capital investments in new technologies or equipment.

The process of providing services from a lean management perspective is based on the following five observations: 1. understanding the assumptions of the concept of the value stream for the client, 2. defining the stream creating value for the client, 3. mapping the value streams, 4. using the pull system, 5. striving for excellence and eliminating waste (Womack & Jones, 2001, pp. 22-34). As a result, the lean concept is recognized today as a fundamental business strategy implemented by hotel companies. However, despite its considerable capabilities, there are doubts as to how the concept will adapt to the environment.

Lean management tools are used to collect, process, and monitor data that arise in the production/service process. They also enable detection of discrepancies that occur during the performance of services or manufacturing processes. All lean management tools are distinguished by a planned, repetitive, and scientifically based manner of proceeding when using them (Borkowski et al., 2014; Wolniak & Skotnicka, 2005). The importance of individual lean management tools has been presented in detail in the literature. However, in practice, by the conducted research, the use of the lean management concept to improve processes related to guest service and the provision of services by a hotel company concerns the proper management of resources, eliminating

waste and unnecessary costs (Helmold, 2011; Ulewicz & Kucęba, 2016). Nevertheless, the literature indicates that lean research in the services sector remains at an early stage. Despite their proven effectiveness in manufacturing enterprises, an identical way of applying lean principles in services is not possible due to differences between the production of products and the provision of services (Gupta et al., 2016).

Considering the potential significance of the concept for the development of hotel enterprises, the purpose of the article is to identify lean management tools used to improve guest service processes and service provision. It was assumed that achieving the above objective would be possible after obtaining the answers to the following research questions:

RQ1) What lean management tools are used to improve selected customer service processes in hotel enterprises?

RQ2) What are the reasons for using lean management tools in the process of guest service and service provision in hotels?

The article consists of two parts. The first of these is of a theoretical nature and presents the benefits associated with the use of lean management in hotel enterprises. The second empirical part presents the results of surveys conducted using the CAWI (Computer Assisted Web Interview) technique using a self-developed questionnaire. The source material was data obtained during the empirical study carried out from September to December 2019 among respondents from 421 hotel enterprises operating in the Polish market. Then, the statistical analysis method was used to compile the data, which used the chi-quart independence test calculated using the Statistica program.

The issues raised in the article have not yet been the subject of research conducted for the hotel market. Therefore, its goal is to fill the gap appearing in the research on the recognition of lean tools used by hotels in selected processes of providing services and hotel guest service. The conducted research shows that the operation of hotel enterprises by the lean concept obliges managers to apply virtually all available tools, techniques, concepts, and methods recognized in management and quality sciences. They make it possible to shape, develop, and make a hotel prosperous in the market in the 21st century.

2. Literature background

Today, the challenge for enterprises is to provide services at a high level and to remain competitive (Locher, 2012). On the other hand, the conditions of the global economy oblige entities to implement transformations in the field of managing services and human resources and to seek savings in the

process of customer service that will affect the added value of the service (Tiamaz & Souissi, 2019). One of the modern concepts that allow achieving these results is lean management.

In the literature on the subject, the concept of lean in the narrow sense is interpreted as slimming or thinning. On the other hand, it is characterized from the broader perspective of flexibility, i.e. the ability to quickly adapt to changes, elasticity meaning a quick and dynamic response to changes (Czerska, 2009) and agility that indicates the ability to survive as well as develop in unpredictable conditions (Bednarek, 2007).

This concept is also referred to as a set of concepts, rules, procedures, and tools that are adapted to streamline the service process to reduce waste (Taj, 2008). It is also formulated from the perspective of philosophy, management methods, and cultural changes (Radnor et al., 2006). Thus, hotel management by the lean concept is not just about applying improvements to your business. It results from a thorough transformation of the way the enterprise operates, and organization and orientation towards strategic goals, among others: creating value for guests, focusing on the way services are provided (so-called value streams) and continuous improvement of the flow of services through the value stream (Maskell & Kennedy, 2007).

The issue of lean management is considered in the literature from the perspective of 1) The socio-technical system, i.e. providing value to customers, 2) A set of techniques aimed at reducing the amount of waste, 3) The philosophy of business management 4) The configurational nature of lean (Bicheno, 2004; Hines et al., 2004; Bhasin & Burcher, 2006; Shah & Ward, 2007; Taj & Morosan, 2011; Tiamaz & Souissi, 2019). For the study, a definition was adopted that defines lean management as a concept whose goal is to eliminate waste and increase customer value while using fewer resources (Shah & Ward, 2007). The role of enterprises using this method is to focus on generating and steadily increasing customer value as well as increasing the efficiency of the service process. Its main task in the process of improving enterprises is the ability to recognize and eliminate activities that do not add value (Drew et al., 2004; Hobbs, 2011).

2.1. Application of lean management concept in the hotel industry

The use of the lean management concept should contribute to situations in which individual elements of the hotel service process are in the right place and time. Therefore, hotel companies should follow the 3M model. The first element is a muda instrument consisting of reducing waste, downtime, unnecessary movements, and various types of waste (time, resources) and other activities that are not of value to hotel guests. Another component of

the model is *muri*, i.e. an instrument that allows limiting the excessive load on employees, machines, processes, affecting staff overwork and downtime caused by ineffective use. In turn, the third module consists of a wall responsible for limiting incompatibilities and irregularity of actions, striving to manage the flow of resources in such a way as to ensure regularity, lack of downtime and constant course of individual processes (Liker, 2016; Caldera et al., 2017).

The overarching goal of lean management is to adapt a hotel enterprise to market management conditions occurring through deep transformations in its organization and functioning (Lichtarski, 2015). The lean concept indicates the recognition of the needs of hotel guests and the identification of elements that are of value to them in the process of providing services. The essence of the concept results from the application of appropriate rules of conduct, thanks to which the company can achieve specific goals (Womack & Jones, 2001). Activities undertaken by enterprises, by Toyota's production system (TPS), consist in the application of five main principles 1) specify customer value, 2) identify the value stream, 3) shape continuous flow (flow), 4) the use of a suction system (pull), 5) the pursuit of perfection (perfection) (Womack & Jones, 2012).

Hotel companies are unlikely to ever reach the ideal level of service provision because as a rule, one area of operation will always need to be improved. The lean management principles presented do not compose a cycle or procedure. It is recommended that they are used simultaneously. A problematic task for hotels may be choosing the right method of improvement from a set of diverse methods, techniques, and lean management tools.

2.2 Characteristics of lean management tools used in the hotel industry

In the literature on the subject and business practice, there are many lean management methods and tools that are used to improve operational processes and modify structures in enterprises. The tools are used during the implementation of the lean management method. According to the definition given in the Polish Dictionary, tools are "something used for some purpose" (Drabik et al., 2019). Thus, the methods and techniques used for some purposes may be called tools. The term tools are understood not only as technical objects or devices used in the production/service provision process but also as enterprise management systems, including lean management.

The literature on the subject lacks a clear boundary between the terms: techniques, methods, or management concepts, and most publications also use the terms management tools and instruments. W. Matwiejczuk, based on the analysis of the definition, believes that it is more correct to combine management instruments and tools with management techniques than management methods or concepts (Matwiejczuk, 2009). In this article, with

the reservation indicated above, the term “tool” is used, bearing in mind that when analyzing the literature on the subject, the reader can find this type of procedure interpreted as a concept, method, or technique.

The lean concept uses a combination of various tools to create a flexible organization that manages to respond in real-time to changes inside and outside the organization (Czerska, 2001). The key lean management tools include VSM (Value Stream Mapping), 5S (the concept of workplace standardization), SMED (Single Minute Exchange of Die – the concept of quick changeovers, allowing for increased machine availability time), Poka-Yoke (error prevention method), TPM (Total Productivity Maintenance), JiT (Just in Time), QRM (Quick Response Manufacturing), Kaizen (continuous improvement concept), Kanban (production control method) (Liker & Meier, 2011; Ohno, 2008; Drew et al., 2004; Feld, 2001; Lisiński & Ostrowski, 2006). The main task of the lean management concept is to improve service processes, look for opportunities to reduce waste, process duration, and increase profits (Campos, 2013).

From the perspective of modern management methods within the lean concept, organizational and management tools, the so-called lean toolbox, should be distinguished (Bicheno, 2008). These include all measures that support the lean concept, regardless of the degree of difficulty of application in a hotel enterprise. There is currently no commonly accepted classification of lean management tools. The most important tools mentioned in the literature and used in hotels should be included:

- 1) Just in Time (JiT) – the concept is based on the organization of processes carried out exactly on time. The essence of the method is the assumption that the right product will reach a specific place, at a specific time and in the right amount (Canel et al., 2000, p. 55). Thus, JiT refers to the implementation of production and distribution processes in minimum time. These types of activities help improve the quality of customer service. As a result, the application of the approach to stream flows improves the economic indicators and the efficiency of hotel operations (Barlow, 2002). In turn, the multitasking of employees is the ability to perform many activities at the same time, as a result, there is an increase in productivity, reduction of employment, and greater flexibility of employees.
- 2) Work standardization, which consists of a detailed description of each of the service process activities (hotel guest service), including time cycles, the order in which individual activities are performed, and the minimum number of elements needed to complete the operation. Work standardization covers three aspects: working time, work sequence, and work in progress (Manaf, 2018).

- 3) The 5S program is recognized as a condition for creating a work culture that allows you to quickly recognize and control elements of the work process by observing, without using computers or seeking help from other employees. The method is based on five principles (Acar, 2013, p. 3038):
 - Sort, Organization, Eliminate (seiri) – means the selection of appropriate tools, parts, and instructions, other, unnecessary items should be removed from the workplace;
 - Simplify, Orderliness, Order (seiton) – means careful identification of parts and tools assigned to the position for easy use;
 - Scrap, Cleanliness, Clean (seisu) – means conducting a purity campaign;
 - Standardize, Standardized Cleanup, Proceduralize and Standardized (seiketsu) – means maintaining standards every day to keep your workplace in perfect condition;
 - Sustain, Discipline, Respect and Improve (shitsuke) – means creating a habit of following and maintaining the first four “Ss.”
- 4) Poka-Yoke consists of creating conditions in which a person can't make a mistake and, consequently, for an error to occur, but if a defect appeared, it will be immediately noticed and corrected (Pawłowski et al., 2010).
- 5) Kaizen is a tool enabling individual employees to organize and manage their work. As a result, it leads to standardization, which introduces repeatability and order in the work performed. Thanks to this, employees can easily identify problems and indicate the right solutions. Thus, it relates to improving one's performance as well as work performed, and covers the activities of management members and employees of the organization every day (Gisler, 2015).
- 6) Value Stream Mapping (VSM) is primarily about finding those elements of the enterprise that are not functioning properly. Even if it seems that all areas of the company are working fine, mapping value streams will indicate possible discontinuities, disruptions in the flow of information and materials. Most often, such problems lead to the conclusion that the seemingly well-functioning entity does not bring the expected profit (Manaf, 2018).

Depending on the area of application of lean management tools, they can prompt hotel enterprises to improve guest service processes and services.

2.3. The essence of the process of guest service and the provision of hotel services

The hotel services sector is characterized by the repeatability of operations and significant variability of demand with relatively constant service potential. The indicated conditions make the process of hotel services provision,

compared to other service sectors, a procedure highly susceptible to the occurrence of problem situations occurring during the service relationship. Another criterion for the thorough implementation of the service process in the hotel sector is its provision related to direct service in the presence of the guest. Therefore, the basic procedure in which the hotel company participates is the moment of establishing interaction between the hotel employee and the guest (Martin, 2006). As a consequence, service contact in the hotel sector is characterized by a significant degree of interdependence between the service provider and the recipient. Each form of mutual interaction between process entities has a fundamental role in the quality of services offered by the guest and determines the market success of the hotel company.

The provision of hotel services is deemed to be conducting a business activity, the purpose of which is to provide hospitality for a fee and to meet the basic living needs of persons temporarily staying outside their place of permanent residence. Thus, it consists of providing tourists with basic services (accommodation, meals) and additional – accompanying (recreational, entertainment, and security) in the hotel facility (Witkowski, 2009). Besides, hospitality should be understood as ensuring: comfort, appropriate standard, level of service, the safety of stay, good atmosphere during a stay in a hotel, high professional qualifications, and ethical and moral level of employees (Borkowski & Wszendybył, 2007).

To improve the process of providing hotel and catering services, facility owners implement quality systems and quality management standards (e.g., ISO 9001-2000, 14 001, HACCP, GHP, GMP, GCP, GKP), which are an essential element of the comprehensive quality management technique – Total Quality Management (TQM) (Borkowski & Wszendybył, 2007). As a result of implementing these procedures, it is possible to obtain pro-quality certificates guaranteeing the high quality of services offered. In addition to the standards indicated, the quality of services provided in hotels may also be governed by legal provisions, international standards (codes, recommendations, recommendations, e.g. from the World Tourism Organization), rules used by industry and network organizations (license and franchise agreements), expert opinions, and standards developed by leaders in the sector (Maciąg, 2015). Nevertheless, the level of multidimensionality and diversity of processes that contribute to the provision of services affects the determination of the market position of the hotel. The slight variation and complexity of the process indicates a greater standardization of services. In turn, their increase means that the hotel provides personalized services (Jonas, 2006).

To identify the lean tools used in hotel enterprises, indicators available in the literature were used (Antczak & Gębczyńska, 2016). They affect the ability to quickly make decisions, set appropriate priorities for action, and

improve service processes and services. One of the measures used to supervise the process of providing services is the qualitative service production index (QSP). It concerns the accuracy of the implementation of the plan for the provision of services within a specified period. Measurement of the index necessitates the counting of the number of improperly performed services, which is calculated as the difference between the number of planned services (according to the plan) and the number of properly implemented services. The differences between them are interpreted as an error. The meter has the following formula (Bicheno, 2008, p. 276):

$$QSP = \frac{\text{planned number of services} - \text{the number of services improperly performed}}{\text{scheduled number of services}} * 100\% \quad (1)$$

The next measure used to control the process of providing services is the quantitative service indicator (QSI), which determines the variations in quantity in the process of providing services. QSI is determined by the formula (Gupta et al., 2016, p. 1028):

$$QSI = \frac{\text{number of services rendered}}{\text{planned number of services}} * 100\% \quad (2)$$

Hotel enterprises also use the work efficiency index (WEI), which presents the relationship between the results achieved (the number of services rendered) and the resources used, recorded by the hours worked by employees, directly and indirectly, involved in the process of providing services and servicing hotel guests. This type of relationship can be calculated from the formula (Hemmington et al., 2018, p. 21):

$$WEI = \frac{\text{number of services rendered}}{\text{total hours of employees serving guests}} \quad (3)$$

In the operation of hotel enterprises, the key step to improve the quality of the service process is the ability to coordinate technical quality (hotel equipment, employee qualifications) with functional quality, which results from the way guests are served (behavior, communication skills of the staff and the ability to recognize the needs of hotel guests). Regardless of the manner of interpretation and quality perception in the process of guest service, a hotel company should comply with the following principles (Panasiuk, 2007, p. 79): 1) reliability of implementation, 2) speed of service, 3) reliability and professionalism of service, 4) individual approach to guests.

The process of servicing hotel guests is based on the selection of appropriate means and methods of the behavior of the staff, which allow confirming the client's belief that the staff performs their tasks with only their welfare in mind. Thus, guest service should be seen as a reliable process providing the buyer with goods and services at an agreed time and place, according to his expectations (Payne, 1997). The service of hotel guests can be analyzed from the perspective of both the service provider and the recipient. The hotel owner understands this process as a service standard developed based on his own experience or dictated from outside (e.g., hotel book of standards, hotel chain standards), thanks to which guests' needs are met. In turn, the buyer perceives the service as a difference between expectations concerning its implementation, and their subjective assessment made after the end of this process (Panasiuk & Szostak, 2019).

Internal and external norms in the form of standards are implemented in the processes of guest service and hotel services. The concept of lean management has many tools, but in the case of hotels at the beginning of the mentioned processes, it is necessary to map the process by determining the value of the service, formulating the value stream and the flow of value. The purpose of this process is to shorten the flow time, find and eliminate waste in service and service delivery processes. For this reason, among others, standardization is used in the hotel sector. According to the literature on the subject, two types of standardization can be distinguished: management standards (regarding the internal purpose of personnel management) and operational standards (regarding how to perform work) related to guest service and service provision (Kolińska & Koliński, 2013). Standardization in the concept of lean management is an important way of dealing with waste (*muda*), overloading of personnel and machines (*muri*) and instability in the process of providing services and guest service (*mura*), where it is impossible and not recommended to use full automation of tasks.

3. Research approach and methods

To identify lean management tools that are used to improve the guest service process and the provision of services by hotels, data collected during the empirical study was used. The research problem undertaken in this study concerned the determination of 1) What lean management tools are used to improve selected customer service processes in hotel enterprises? and 2) What are the reasons for using lean management tools in the process of guest service and hotel services? The identification of lean management tools used in the analyzed processes was made following a typical research process presented in Figure 2.11.

The main purpose of the study was to compare theoretical and practical knowledge and to learn the opinions of respondents from hotel companies dealing directly or indirectly with lean management about the tools used to improve guest service processes and services. Based on a critical analysis of the literature on the subject, the possibility of using the lean management concept to improve selected actions taken in hotels was identified.

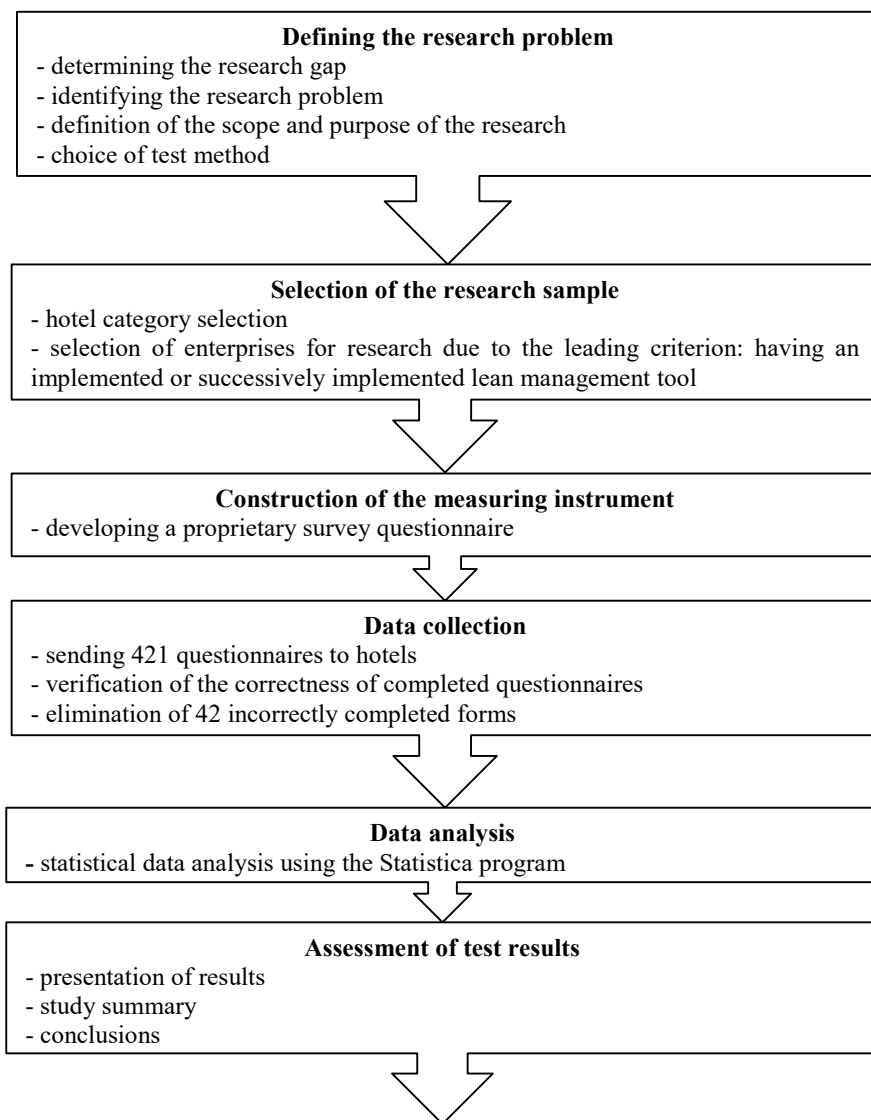


Figure 2.11. Stages of the research process

The research goal was tried to be achieved by processing empirical data collected using a questionnaire. The study was quantitative. The survey, which used an online survey using the CAWI (Computer Assisted Web Interview) technique, was carried out from September to December 2019. The author's questionnaire via the online tool was monitored by the LimeSurvey system, which is based on the server-respondent relationship. The electronic questionnaire was distributed among the addressed hotel enterprises from the level of the online platform. The return of the obtained answers took the form of a matrix of data created in real-time by the respondents. The use of this type of research method was acceptable because all hotels in the higher (five and four-star) and medium (three-star) market segments have Internet access.

The initial stage of the study consisted of sending an electronic invitation to participate in the study to 421 owners, directors, or managers (respondents) of hotel enterprises operating in the Polish market, dealing directly with the practical application of lean tools in the process of guest service and service provision. The invitations included: a cover letter, basic information about the project being implemented, as well as a hyperlink to the questionnaire (CAWI) with instructions on how to complete it. The messages were sent to facilities from the three, four, and five-star segment, which have implemented or are gradually implementing lean management tools. The condition for completing the survey was a basic knowledge of lean issues, which is why the respondents' answers were very diverse and depended on their substantive and empirical knowledge. Thus, the group of hotels selected for the study was not chosen randomly but based on previously established contacts. Three electronic letters were sent at equal intervals of several days. Only one respondent from a given hotel company could participate in the survey. Technical support via email was provided for the target group participating in the study. Then, after completing the questionnaire, the answers were imported into the resulting database. A total of 204 hotel enterprises (48.46%) responded to the survey. The next stage of the research was a verification of the correctness and completeness of surveys, in connection with which 42 questionnaires were eliminated from further research. Finally, 162 (38.48%) correctly completed questionnaires were obtained and qualified for further analysis. After completing the survey, a thank-you message was sent to the respondent's e-mail address for the time spent completing the form. The choice of this type of method was made due to the short-term duration of the study and its relatively low cost.

The key goal of the research was to compare theoretical knowledge with business practice, to check what lean management tools are used to improve selected customer service processes in hotel enterprises and 2) What are the reasons for using lean management tools in the process of

guest service and service provision in hotels? Information obtained based on surveys was only quantitative.

To implement the above-mentioned objectives, a research tool was used, which was the author's questionnaire. It consisted of 15 questions divided into two thematic parts: 1. Conditions influencing the use of lean management tools, 2. Identification of lean tools used to implement services from the perspective of improving guest service processes and hotel services. The form was prepared in Polish, and to ensure the correct translation of the original lean tool items, the retranslation procedure was used as part of collective and multiple translations. During the survey, single or multiple choice open and closed questions were used. Respondents were asked to identify tools that have an effect on improving selected service processes by completing the developed form. The final part of the questionnaire was metric questions, which concerned, among others, the position held by the respondent, the year when the hotel started operating, the number of employees, and the category of the hotel enterprise. Following the purpose of the survey, the respondents were asked to identify lean management tools and determine the reasons for their use, thanks to which hotels obtain appropriate effects in improving guest service processes and services.

All respondents subjectively assessed individual criteria. Then the responses received on their basis were added together, structured, and absolute valued. The study also used a 4-stage Likert type scale, with values from 1 "low importance," 2 "medium importance," 3 "high importance," to 4 "very high importance" (Camparo & Camparo, 2013, p. 82). As a consequence of indexing the obtained responses, descriptive statistics (weighted average) were used to determine the overall parameter of the opinion. The rank categories used provided a precise classification of answers to individual questions (from the lowest to the most important parameters). The positions presented by the respondents allowed the identification of lean management tools used by hotel enterprises and their use to improve the process of guest service and service provision.

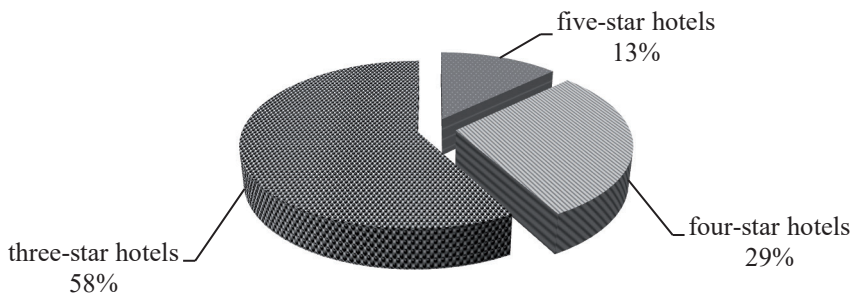


Figure 2.12. Structure of the surveyed hotels by category (%)

The survey was carried out among 94 three-star hotels, 47 four-star, and 21 five-star hotels. The percentage share of enterprises is shown in Figure 2.12. A significant group of respondents was hotels operating on the market for over 10 years. Their operating time contributes to obtaining knowledge from the perspective of understanding the environment of entities and changes occurring in it. In turn, when analyzing the complexity of research and the nationwide nature, it is necessary to emphasize their cognitive potential.

In the analysis of the differences in the answers regarding the lean management tools used, which enable the improvement of guest service processes and the provision of services between the hotel categories studied, the chi-square test of independence (also known as the Pearson test) was used to check the hypothesis. The dependence analysis was presented in the form of a summary of the number and percentage structure of answers received to questions in the compared categories of three-, four- and five-star hotels (contingency tables). To assess the level of response diversity, questions regarding the premises prompting hotels to use lean tools in the case of the processes analyzed, the regularity of the target population was reflected in the target facilities (Sokołowski, 2010).

Besides, to determine the extent to which the results obtained, with the questions raised, may constitute random differences, methods of statistical inference (so-called statistical tests) were used. For the analysis of contingency tables, the chi-square test of independence was used. The result of the statistical test is the so-called test probability (p), whose low values indicate the statistical significance of the analyzed relationship. Usually, the results are considered from the perspective of the following standards taking the form (Francuz & Mackiewicz, 2007):

- $p > 0,05$ then there is no basis for rejecting the null hypothesis because the tested: difference, dependence, effect do not show significantly statistical feature;
- $p < 0,05$ informs about a statistically significant relationship between the variables studied (the result is marked by *);
- $p < 0,01$ signals a highly significant relationship (conventionally identified with **);
- $p < 0,001$ indicates a very high statistical significance of the relationship (result determined by ***).

The chi-square test is used to compare the proportions obtained from a sample with a defined hypothesis when comparing two or more structures. The function value is calculated according to the following formula (Sobczyk, 2020, p. 13).

$$x^2 = \sum_{i=1}^l \sum_{j=1}^k \frac{(n_{ij} - \widehat{n}_{ij})^2}{\widehat{n}_{ij}} = \sum_{i=1}^l \sum_{j=1}^k \left(\frac{n_{ij}^2}{n_{ij}} \right) - n \quad \widehat{n}_{ij} = \frac{n_i \cdot n_j}{n} \quad (4)$$

where:

\widehat{n}_{ij} – theoretical numbers,

n_i – number of sample elements corresponding to level x and characteristics X ,

n_j – number of sample elements corresponding to level y_j of feature Y ,

n_{ij} – number of sample elements corresponding to level x and feature X and level y_j of feature Y ,

n – a sum of elements of the sample corresponding to level x and feature X and level y_j of feature Y ,

k – number of columns,

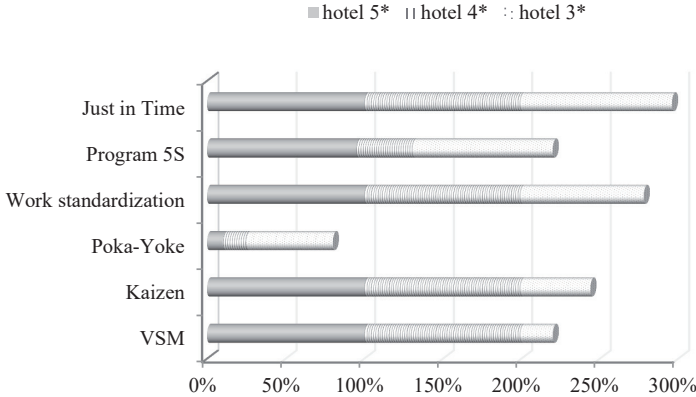
l – number of rows.

The test presents a null hypothesis that recognizes that the observed values correspond to a certainly expected distribution (H_0 – variables are independent). However, the alternative hypothesis assumes that the distribution is of a different type than assumed (H_1 – variables are not independent). Low values of test probability p make it possible to reject the null hypothesis. On this basis, it can also be concluded that there is a relationship in the entire studied population that occurs between the two analyzed features (Pułaska-Turyna, 2011).

The questionnaire replies received during the survey were used to calculate the factors indicated. Their values are presented in the drawings and tables in the next part of the study – research results.

4. Results and discussion

The first stage of research shows that the practical application of the lean management concept requires the use of numerous tools and techniques to improve the processes of hotel guest service and service provision. All these types of activities are usually classified as quality management tools. The purpose of their implementation is to improve productivity/service, reduce waste, and streamline processes implemented in a hotel enterprise. During the next stage of research, the frequency of application of selected lean management techniques and methods used to improve selected service processes was recognized (see Figure 2.13).



* Data do not add up to 100% in individual hotel standards, because respondents could choose more than one answer.

Figure 2.13. Lean management tools used to improve selected processes in hotels (%)

Figure 2.13 presents the percentage share of selected lean management methods and techniques in the management process, which are regularly used by hotel companies in the Polish market to improve guest service processes and services. The summary of results indicates that the most commonly used tools by five-star hotels are: Value Stream Mapping (VSM), kaizen, work standardization, and Just in Time. These techniques are used by all the studied hotels (21) operating to the highest five-star standard. In turn, the 5S program uses 20 objects to improve the analyzed processes.

The research shows that all four-star facilities (47) operating in the higher segment of the market use identical lean management methods that enable the improvement of selected processes, such as hotels with the highest five-star standard, i.e. VSM, kaizen, work standardization and Just in Time. Among the examined three-star facilities (94 hotels) from the average market segment, the most popular methods are: Just in Time (93 hotels), the 5S program (86), and work standardization (76). However, the following lean management tools are used the least in five-star hotels: Poka-Yoke (2 objects) and four-star: Poka-Yoke (7) and three-star: Value Stream Mapping (10).

The surveyed hotel enterprises showed the use of many typical lean management tools. The use of individual methods should begin with mapping guest service processes and services by determining the value of the service, formulating a value stream, as well as value flow (Feld, 2001). Hotel staff can perform more tasks that will benefit buyers when properly implemented lean management tools are used to increase their efficiency. Tasks carried out following the principles of work standardization, i.e. according to a specific sequence of activities and other standards guarantee the right cycle of the

processes analyzed. As a consequence, they ensure identical implementation of the service process and repeatability of the quality of services rendered.

From the perspective of the application of individual lean management methods and tools, it seems interesting to determine which of them directly affect the improvement of the process of guest service and the provision of services by hotel enterprises (see Table 2.18). Therefore, the following hypotheses were verified using the chi-square independence test:

H0: The use of lean management methods and tools to improve selected processes does not depend on the hotel standard.

Alternative

H1: The use of lean management methods and tools to improve selected processes depends on the hotel standard

Table 2.18. Chi-square test results for the use of lean management tools to improve guest service processes and hotel services

Lean management tools	hotel category						statistics		
	5*		4*		3*		χ -square	df	p
	no	%	no	%	no	%			
Program 5S	20	95	17	36	86	89	74,19512195	2	p<0,001***
Value Stream Mapping (VSM)	21	100	47	100	19	20	16,82758621	2	p<0,001***
Poka-Yoke	2	10	7	15	53	55	76,48387097	2	p<0,001***
Just in Time	21	100	47	100	93	96	49,54037267	2	p<0,001***
Kaizen	21	100	47	100	43	44	10,59459459	2	p<0,001***
Work standardization	21	100	47	100	76	78	31,54166667	2	p<0,001***

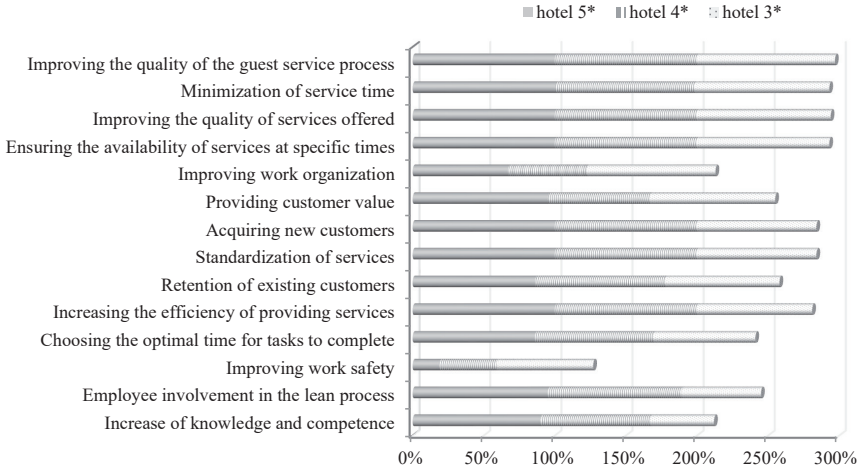
Note: n – population size; n_0 – number of responses from respondents; the materiality level of difference adopted $\alpha = 0,05$; the number of degrees of freedom $df = 2$, level of significance 0,05 read from tables; the critical value of the test chi-square, for $df = 2$ is according to the tables 5,991.

*** a result with a very high statistically significant relationship, $p < 0,001$

Based on the statistical analysis of the collected data, it should be stated that there is a statistically highly significant relationship between the hotel standard and the application of lean management methods and tools in improving the processes examined. For the analyzed variables, “p” assumes a very small value ($p < 0,001$). Therefore, it should be rejected H_0 presenting the absence of any dependence between the analyzed features and assumed H_1 . The alternative hypothesis indicates that lean management tools are used to

improve guest service processes and services depending on the hotel category. The values in Table 1 confirm the correctness of this observation.

According to the first stage of research, it should be stated that lean management tools and methods are used to improve selected processes of hotel enterprises, among others, to detect and eliminate various types of waste. Therefore, in the next stage of the research, the respondents defined the premises for the use of lean tools in hotels (see Figure 2.14).



* Data do not add up to 100% in individual hotel standards, because respondents could choose more than one answer.

Figure 2.14. Reasons for using lean management tools in hotels (%)

The research shows that the use of the lean tool in all five- and four-star category hotels (21 – 5*; 47 – 4*) is supported by premises that improve the process of providing services and customer service. Their improvement is based on the implementation of appropriate measures to counteract waste during the implementation of individual stages of the process. Therefore, hotel companies improve service by focusing on identifying needs, meeting the expectations and satisfaction of guests, because they are the most important link in the process of providing services. According to respondents, the tools used by hotels allow for: increasing efficiency and minimizing the time to provide services, standardizing services, ensuring their availability at a specified time, attracting new hotel guests, improving the quality of customer service and service provision. Less significant reasons turned out to be activities related to the improvement of safety (4 – 5*; 19 – 4*) and work organization (14 – 5*;

26–4*). In turn, respondents from three-star hotels considered the improvement of the quality of the guest service process (91 facilities) and the quality of services (88) as well as the minimization of service provision time as the key motives for using lean tools to improve the examined processes (89). For the examined objects, the secondary goal in process improvement is the increase of employees' knowledge and competence, which are used to improve customer service and service provision (42 hotels) and the degree of hotel employees' involvement in the application of lean management tools (53).

It should be concluded that the reason for using lean management tools according to the opinions of respondents from hotel companies participating in the survey is the search for solutions that determine the basis for the provision of services of the highest quality with the least consumption of resources and the lowest financial outlays. Thus, the main reason for using lean is to achieve high efficiency and effectiveness of the work of guest departments in hotel enterprises.

The research shows that, according to the respondents' opinions, the fundamental reason for the use of lean management methods and tools by hotel enterprises is primarily the improvement of the guest service process concerning their greater satisfaction and the quality of services provided. These types of tools can be used to improve the processes studied, because the main feature of lean management is to place the buyer in a central place, while the main task of hotels is to provide hospitality by guaranteeing comfortable conditions of stay and an appropriate standard of services offered. Therefore, if lean management tools are properly applied, the functioning of customer service departments and the provision of hotel services will be improved. As a consequence, the organization of work stations is improved, the quality of processes increases, and the number of errors made and waste are eliminated. These factors contribute to the increased satisfaction of hotel guests.

In the hospitality sector, lean management tools have not been recognized yet and no prerequisites for their use to improve guest service processes, and service providers have been identified. Based on the conducted research, it can be stated that their use in the analyzed processes requires hotels to be properly adapted and to take into account the specific features of the service process and hospitality principles.

The research confirms the effectiveness of the use of lean management tools in hotel enterprises, whose consequence or basic assumption is to improve the process of guest service and service provision. On the other hand, analysis of the literature on the subject indicates that the concept of this type assumes the elimination of all kinds of waste that occurs during the implementation of the examined processes, including correcting deficiencies and errors in the cycle and response time to improper performance of

services (Womack & Jones, 2001). These elements are reflected in the quality, efficiency of implementation, standardization of services offered by hotels and the commitment of staff to improve processes. To counteract the mentioned negative effects, hotel companies use lean tools that enable streamlining processes by improving the quality of services and the service process (standardization), ensuring the availability and effectiveness of services and reducing the time needed for their implementation in the process of guest service. Elimination of waste-related activities is a potential source of improvement for the processes studied, depending on the hotel category.

The economic practice also indicates several solutions used to improve the level of processes analyzed. The standardization of services, resulting from the appropriate choice of patterns in the provision of services and customer service, is of fundamental importance in this area. It should also be emphasized that only comprehensive methods and tools allow obtaining a positive effect in improving the analyzed processes. The current state of knowledge in the field of management and quality sciences confirms that one of the most effective tools in this respect is lean management. The basic reasons for using these type of tools, i.e. the availability of services, increasing their efficiency, standardization and systematic improvement of processes occurring in the company for the quality of services provided, are the appropriate basis for improving the process of providing services that meet the expectations of hotel guests.

Further research directions of the application of the concept of lean management in hotel enterprises should focus on determining and improving methods for measuring the effects of implementations of selected lean management tools at individual stages of improvement made in guest services departments.

Summing up, lean management is at the center of interest of hotel managers, because it is valued from the perspective of a concept that brings measurable results. It influences the improvement of guest service processes, rendering services, and creating added value. As a result, this type of conditioning allows waste reduction and cost-effective management of hotel resources by hotel businesses.

5. Conclusion

A significant increase in interest in improving the process of providing services and hotel guest service is noticeable among hotel enterprises operating in the conditions of globalization in a competitive market. Hotels, whose goal is to improve the implementation of these processes, should pay special attention to the need to eliminate waste, increase efficiency, work standardization, and

quality of customer service. Actions taken in the field of lean management concept focus on the use of a wide set of tools and techniques leading to comprehensive identification and elimination of waste, which is focused on improving processes implemented in enterprises.

The purpose of this article was to identify lean management tools to streamline processes related to guest service and hotel services. Improving the process of managing hotel enterprises concerned the answers to the questions: 1) What lean management tools are used to improve selected customer service processes in hotel enterprises? and 2) What are the reasons for using lean management tools in the process of guest service and service provision in hotels?

The practical conclusions that flow from the empirical research obtained indicate the use of the same tools in the higher hotel segments, i.e. VSM, kaizen, work standardization, JiT, which are used to improve the processes studied. In turn, among the facilities operating in the three-star category, the most popular tools in this area are JiT, the 5S program, and work standardization. As the results of the research suggest, they are used to improve processes and focus activities on the diagnosis of needs aimed at meeting the expectations of hotel guests. Tools indicated by respondents streamline the process of providing services and customer service as a result of increased efficiency, minimization of execution time, standardization, and quality improvement. Also, the purpose of their application is to achieve the appropriate degree of satisfaction of customer requirements to the quality and flexibility of service provision. Thus, lean tools allow hotel services to be adapted to the requirements of buyers, which in turn translates into an increase in their satisfaction. The issues presented in the article do not exhaustively cover the issues related to the identification of lean management tools that improve guest service processes and the provision of services in hotel enterprises. The composition of methods, tools, and instruments shaping the concept of lean is constantly undergoing change and modification.

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Biographical note

Małgorzata Sztorc, Ph.D. in Management from the Cracow University of Economics, Assistant Professor in the Department of Management and Marketing at the Kielce University of Technology. She leads research in the field of strategic management. Experienced hotel management practices. Member of the editorial team of *Frontiers in Management and Business (FMB)*. Her main interest and research areas include strategic management issues, contemporary concepts and management methods, global business strategies, tourism, hotel management, and business models.

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Career orientation of Polish and Chinese students from the perspective of national culture

Anna Mazurkiewicz¹

Abstract

It is an assessment of the impact of national culture on career orientation with regard to the identification of favored values for the career of students of Economics in Poland and China. The characteristics of national cultures were based on research by Hofstede and associates. Career orientation was measured by means of a shortened version of the Career Orientation Questionnaire (COI) developed by Schein by Igarria and Baroudi. The study was conducted on a group of students from Poland and China. Respondents, regardless of their nationality, ranked individual career anchors in a similar way, which means that almost the same values are important to them. Stability of employment and development of competences are the most important for them. The results, especially the opinions of Chinese students, do not confirm in certain cases the characteristics of cultural patterns made by Hofstede and associates, which is the basis for the supposition that national culture appears rather as a moderator, not a reason for professional decisions. The conclusions were based on research conducted on a small group of respondents, which is not a basis to generalize them. Knowledge about the values important to an individual will allow them to match better the professional development opportunities to their needs, and prediction of their professional behavior. For employees, it is an argument that allows them to make a decision about further focusing on their professional development. The orientations of young people towards their careers in culturally different countries – in Poland and China – were identified. The association of the favored careers with national culture was indicated, taking into account its individual dimensions.

Keywords: national culture, professional career, career orientation, Poland, China

¹ Anna Mazurkiewicz, Ph.D., Assistant Professor, Department of Economics and Management, Institute of Economics and Finance, University of Rzeszow, Aleja Rejtana 16c, 35-959 Rzeszów, Poland, e-mail: annam@ur.edu.pl (ORCID ID 0000-0003-2764-284X).

1. Introduction

The choice of a specific career path is particularly important for people who start their professional activity, who make the transition from the education stage to the labor market since career planning begins during their education. This period is also relevant for an employer to attract employees who meet expectations and support them in the development of their future careers in an organization (Gunkel, Schlägel, Langella, Peluchette, & Reshetnyak, 2013). At the same time, the role of the organization in career management has become more limited, as the main burden of responsibility for its course has been shifted towards an individual (Bohdziewicz, 2010).

Currently, more and more attention is paid to the importance of individual factors in career planning at the level of an individual and an organization (Gunkel et al., 2013). For both organization management and career research, it was important to emphasize the impact of national culture due to the international nature of the labor market (Briscoe, Hall, & Mayrhofer, 2012). Career, which is a motive of human action, results from the hierarchy of values adopted in a given society (Bauman, 1965). The effectiveness and efficiency of management methods, including career, depend primarily on the environment where the organization and the individual operate. Employees react to motivational stimuli differently as their behavior at work is influenced by different values (Lucia-Casademunt, García-Cabrera, & Cuéllar-Molina, 2015).

The paper deals with the issue of the importance of cultural differences in the area of young people's favored values for a professional career when they make the transition from the education system to the labor market. The problem was referred to two culturally different societies – Polish and Chinese. The purpose of the paper is to determine the importance of national culture in professional career management. In particular, the researcher looked for answers to the following research questions:

RQ1: What are the differences and similarities between the cultures of Poland and China?

RQ2: How does national culture affect a professional career?

RQ3: What are the similarities and differences between students' favored careers in Poland and China?

The considerations about value systems help to better understand the attitudes and behaviors of employees. The study adopts a cultural perspective in comparative career research to identify differences between the countries. To achieve the purpose, the literature on the subject was analyzed, and empirical

research was conducted whose results were subjected to a qualitative analysis by means of selected statistical methods.

2. Literature review

2.1. National culture dimensions

Nowadays, the role of culture in managing organizations is unquestioned (Sitko-Lutek, 2015). Particular importance should be attached to the impact of national culture, which is a factor determining management practices, including human resources management. It also affects the activities of an individual, including their professional activity. It is defined as values, expectations and behaviors learned and shared by a group of people, passed down from generation to generation (Graham, 2003, after Rozkwitalska, 2008), collective mind programming that “distinguishes members of one group or a category of people from another” (Hofstede & Hofstede, 2007, p. 17). These programs are reflected in the behavior of individuals within the organization (Trompenaars & Hampden-Turner, 2002). Trompenaars and Hampden-Turner (2002) define culture as a way a group of people solves problems and dilemmas.

Hofstede’s theory (1980, 1983, 2001), which presents cultural dimensions to explain people’s behavior in organizations, is one of the popular models of the national culture dimension. According to the author, societies differ in the way they solve problems that are common for all countries. On the basis of his research, the following dimensions of culture, which are its measurable aspects and allow determining the position of a given culture in relation to others, were identified: Power distance, Individualism/Collectivism, Masculinity/Femininity, and Uncertainty avoidance. As a result of further research, this list was supplemented with long-term versus short-term orientation (Hofstede & Hofstede, 2007). Then the sixth dimension, described as Indulgence versus Restraint (Hofstede, Hofstede, & Minkov, 2011), was taken into account.

Power distance reflects the attitude towards social inequalities and informs about dependency relations in a given country. It is defined as the range of expectations and acceptance towards an unequal distribution of power expressed by less influential members (subordinates) of an institution or an organization.

Individualism/Collectivism is another cultural dimension where interpersonal relations are the measure of a division. In collective societies, the good of the group is prioritized over the good of the individual, while in individualistic societies, the ties between individuals are loose and a person focuses primarily on themselves, and their family.

The dimension that Masculinity/Femininity creates is associated with the social roles performed by men and women. In masculine cultures, gender-related social roles are specified, while femininity is a characteristic of societies where the social roles attributed to both genders are intertwined, and the pursuit of a career does not depend on gender.

Uncertainty avoidance means the fear felt by members of a given culture of new, unknown, or uncertain situations. It concerns the uncertain future and the anxiety it causes.

Long-term versus short-term orientation is the fifth dimension that reflects society's orientation towards further or closer goals. Long-term orientation is associated with the development of virtues that will bring benefits in the future, especially perseverance and economy, whereas short-term orientation is characterized by caring for virtues related to the past and the present, such as respect for tradition, "face preservation" (dignity, respect, prestige) or fulfillment of social obligations.

Indulgence versus Restraint is a dimension regarding the degree of control over human desires. Indulgent societies enable basic and natural human desires to be satisfied, which causes enjoyment of life and fun. In restrained societies, the satisfaction of needs is suppressed and strictly regulated by social norms.

2.2. Virtues valued in professional work – Schein's concept

The concept of career in the literature on the subject is interpreted differently (Miś, 2007). This paper adopts its holistic interpretation, according to which it is associated with the whole of human life (Miś, 2007). The importance of values for the individual should be emphasized, which means that a career is defined personally (Bańka, 2007). Schein (1985, 2007) states that there is a relationship between the kind of career chosen by an individual and their motivations and needs, the declared hierarchy of values, and perceived competences. He identified eight career anchors, which are a set out in the following elements (Schein, 2007):

- technical competence – related to the need to achieve professionalism, the development of knowledge and skills;
- managerial competence – related to the pursuit of vertical promotion, gaining new experience in managerial positions, increasing the scope of power;
- autonomy – concerns the need to act without restrictions associated with red tape and an autocratic style of management;
- security – job security and a stable lifestyle (little need for change) are the motives for an action;

- creativity and entrepreneurship – characteristics of creative people who strive for the development of something new (a product or a service, starting their own business),
- sense of service – it is a characteristic of individuals for whom help and providing support to other people is important;
- pure challenge – characterizes people interested in overcoming barriers and restrictions, solving problems, competition, taking risks;
- life-style integration – features individuals striving to maintain a balance between work and private life, willing to give up higher wages in favor of time for loved ones.

The compliance of the individual's value system and the virtues that are important for an organization is important to achieve both the employee's goals and the employer's goals. The opportunity to develop a career in line with the favored values means that such individuals achieve a higher professional position and a higher level of job satisfaction than those who do not see this compliance (Zalewska, 2000).

3. Research methods

Empirical studies were carried out to achieve the purpose of the paper. They were implemented in 2019 in Poland and in China, and 138 students of Economics including 82 from the University of Rzeszów and 66 from Jinon University participated in the research. In total, 150 questionnaires were distributed, of which 92% were fully completed.

The selection of the sample was purposeful, due to the objective of the research, and made comparisons between representatives of selected groups (Jabłońska & Sobieraj, 2013; Miszczak & Walasek, 2013). The age of respondents and the major of study were adopted as the selection criteria. Due to the unrepresentativeness of the sample (the method of its selection and small size), there are no grounds for statistical conclusions regarding the entire population. The samples were matched, i.e. similar in every measurable respect, except for the nationalities of the respondents (Hofstede, 2013a).

Women constituted almost 77% of the respondents. The proportions determined according to the gender criterion correspond to the structure of students and result from the specificity of the major of study where the research was conducted. The average age of the respondents refers to 22.2 years, and the average professional experience to 9 months, while 61% of the respondents did not have any professional experience at the time of the research. For the needs of the paper, monoculturalism of the groups was assumed, and as a result, it was possible to identify the characteristic features of career management for individual dimensions of culture (Mazur, 2013).

The research presented in the paper was part of a broader study on career management carried out by the author as part of her own research. This study is the first part of the presentation of the results. The study was conducted by means of a survey following the rights of anonymity and voluntary nature of respondents. The tool described in this article is a part of a solution developed for the needs of comprehensive research.

The assessments of individual dimensions of culture for Poland and China, including the importance of career management, were made on the basis of the results of Hofstede and associates (Hofstede & Hofstede, 2007; Hofstede et al., 2011). All dimensions: power distance, individualism/collectivism, masculinity/femininity, uncertainty avoidance, long-term orientation, indulgence/restrictiveness were assessed on a scale from 0 to 100. The authors made an evaluation on the basis of the Values Survey Module (VSM) 2013 (Hofstede, 2013b) developed to compare the values and moods affecting culture for similar respondents from two or more countries or regions. The questionnaire consisted of 30 statements, of which 24 were related to specific dimensions of national culture – each was assessed by means of four closed questions, and the metric questions represented the remaining part.

A short version developed by Schein (1985) Career Orientation Inventory (COI) by Igarria and Baroudi (1993) was used to assess career orientation. A short version allows a comparison of scores across various areas (functions), organizations, and industries. In addition, the short and standard form is not a barrier in using the tool while being a universal solution (Igarria & Baroudi, 1993). The inventory contained 25 statements, of which 15 related to the importance of each of the issues connected with career (assessed on a scale from 1 – “meaningless” to 5 – “essential”), and another ten related to preferences for careers assessed on a scale from 1 – “I totally disagree” to 5 – “I totally agree.” The issues concerned nine individual career anchors, which were identified by the authors based on Schein (1985) and their own research. The anchors included technical competences, managerial competences, autonomy, creative entrepreneurship, dedication to the case, challenge, and lifestyle – three statements were related to each of these anchors in the questionnaire, while employment stability and geographical security were measured by two statements.

The career anchor, which is a key issue in questionnaire research, is a self-concept, a set of talents and abilities as perceived by an individual, basic values, and above all, motives and career needs (Schein, 2007). The dominant and unchanging nature of certain motives, the values that an individual does not give up when making a choice regarding self-development, directs, limits, stabilizes, and integrates their career (Schein, 2007). The career anchor shapes values important in the life of an individual, and determines their views for the future (Schein, 1975, after Igarria, Meredith, & Smith, 1995).

4. Results and discussion

4.1. Career management in Poland and China with respect to the cultural aspect

The results of the national culture assessment of societies by Hofstede and his team are presented in Table 2.19. They show that both countries are among those accepting inequalities between people – Poland in this dimension scored 68, while China scored 80 on a scale from 0 to 100. This proves the hierarchical nature of both societies – in Poland, subordinates expect superiors to show them what to do. These features are intensified in China, where centralized power is typical. Individuals are influenced by formal authority, subordinates obey superiors and formal regulations, and recognize inequalities as natural.

Table 2.19. The characteristics of the national culture of Poland and China

Dimension	Poland	China
power distance	68	80
individualism/collectivism	60	20
masculinity/femininity	64	66
uncertainty avoidance	93	30
long-term orientation	38	87
indulgence/restrictiveness	29	24

Source: <https://geerthofstede.com>.

Societies with a large power distance prefer specific rules regarding career opportunities. The organizational solutions applied are conducive to vertical promotions related to an increase of remuneration and an improvement of status. At the same time, lean organizational structures limit the freedom of competition within the organization and employee participation; they also mean autocratic leadership (Konecki, 2007). Table 2.20 summarizes the impact of the dimension on shaping the professional career of an individual.

The value of the individualism coefficient for Poland and China is 60 and 20, respectively. Such results mean that Poland is assessed as an individualist country, while China is an example of a highly collectivist country. In the case of Poland, this means that the employer–employee relationship is associated with mutual benefits, and individual achievements are the basis for employment and career development. The employee’s independence from the organization is emphasized, and the principal burden of responsibility for the course of their career is shifted towards them. Despite this, the organization also participates in the employee’s professional development as it undertakes activities related to planning and developing a professional career.

Table 2.20. Power distance versus professional career

Small power distance	Large power distance
<ul style="list-style-type: none"> • cooperation of superiors and subordinates in order to achieve organizational goals • the importance of initiative and active participation of employees in determining career paths • favorable horizontal career due to preferred flat organizational structures, striving for decentralization • equal status of physical and office work 	<ul style="list-style-type: none"> • promotes vertical advancement and pay rise • clarified employee development principles, development decisions taken in the organization • guidelines on how to implement the tasks • widely accepted privileges and status signs • office work valued higher than physical work – large remuneration gap

Source: Author’s own research based on Hofstede & Hofstede (2007).

Polish culture, although individualistic, is also hierarchical. Hence, two levels of communication between superiors and subordinates are necessary. As well as a formal one, indicating the role of an expert responsible for the development process (Mazur, 2013), there is also a personal contact, thus emphasizing the importance of each individual, in spite of the lack of equality.

In China, however, individuals act in favor of the group, not necessarily their own. Opportunities for professional development depend on group affiliation, relationships at work are similar to family relationships, and are more important than the implementation of tasks. There is a strong dependence of employees on the organization where conditions are created for professional development, including career implementation. Table 2.21 presents the impact of the dimension on a professional career.

Taking into account another dimension, Poland and China, with a score of 64 and 66 respectively, are assessed as masculine societies. This means that success is important in these countries, and its need is met at the expense of family and free time. Employees are willing to emigrate for a better job and higher pay. The work is carried out until late (which applies in particular to services). For masculine societies, competition and striving to achieve the best possible results (place in the ranking), which determine the amount of remuneration and recognition for the employee, is characteristic. Honesty is important (Table 2.22).

The results regarding the dimension of avoiding uncertainty significantly differentiate Poland and China. Poland, with a score of 93, is a country that strongly avoids uncertainty, which means that security is an important factor motivating employees who strive for stable employment. The Poles feel threatened by ambiguous or unknown situations, which is why there is a strong need for clarification and formalization. The current regulations limit the creativity of individuals, despite their hard work.

Table 2.21. Individualism/collectivism versus professional career

Collective society	Individualist society
<ul style="list-style-type: none"> • professional stability • focus on the group’s goals and loyalty to it, development of individual professional careers of minor importance • an activity of the organization for the benefit of employees: raising qualifications (training), favorable working conditions and using the employees’ potential 	<ul style="list-style-type: none"> • greater professional mobility • acting in the interests of the employer only when individual needs are being met • decisions regarding professional development depend on individual skills and achievements • carrying out tasks more important than interpersonal relations • the need for free time, freedom of work style and a challenging job that gives a sense of satisfaction • individual responsibility for the type and development of a professional career

Source: Author’s own research based on Hofstede & Hofstede (2007).

Table 2.22. Masculinity/femininity versus professional career

Masculine society	Feminine society
<ul style="list-style-type: none"> • pursuing a career is a man’s duty and a woman’s free choice • increasing the scope of competences, emphasizing achievements and creating greater opportunities for promotion and competition • recognition more important than the need for belonging • remuneration adequate to the results achieved, additional remuneration more valuable than free time • work ethos based on the principle of „you live to work” 	<ul style="list-style-type: none"> • pursuing a career as a free choice regardless of gender • the importance of people-to-people contacts and mutual assistance • the need to belong more than recognition • remuneration in accordance with the principle of equality (as needed), free time more valuable than additional remuneration • the dominant belief „you work to live”

Source: Author’s own research based on Hofstede & Hofstede (2007).

On the other hand, Chinese society members feel comfortable with ambiguity – a score of 30 means weak avoidance of uncertainty. They are very enterprising, which is confirmed by a large percentage of family enterprises among all companies that, additionally, are mostly economically successful (Nikodemka-Wołowik, Bieliński, & Bednarz, 2017). Compliance with laws and rules can be treated flexibly to adapt to the current situation. The impact of avoiding uncertainty on career management is shown in Table 2.23.

Table 2.23. Uncertainty avoidance versus professional career

Weak uncertainty avoidance	Strong uncertainty avoidance
<ul style="list-style-type: none"> • a frequent change of employer, shorter employment periods • the number of laws and regulations limited to the minimum necessary • positive attitude towards inaction • tolerance of ambivalence and chaos • freedom for creativity, the great importance of entrepreneurship • interpretation of regulations as appropriate to the situation 	<ul style="list-style-type: none"> • less frequent changes of employer, longer periods of employment • the need to clarify and formalize • high importance of experts • employee creativity limited by regulations • the importance of self-employment • career path set out in regulations

Source: Author’s own research based on Hofstede & Hofstede (2007).

The results presented by Hofstede and Hofstede (2007) place Poland (score 38) in a group of normative societies with a short-term orientation, while China (score 87) is an example of a society focused on further goals. These results show respect for tradition in Poland, a relatively low propensity to save and focus on quick results. Short-term orientation weakens entrepreneurship because attaching too much weight to stability and balance inhibits initiative, discourages risk-taking and making changes, and concerns about losing face discourages the continuation of ventures. Excessive attachment to tradition can suppress creativity and innovation when its role is large (Hofstede & Hofstede, 2007).

In turn, long-term societies, such as China, take a more pragmatic approach – they encourage preparation for the future and investment, including in permanent and long-term personal networks. Their representatives show an ability to adapt traditions to changing conditions, as well as perseverance in achieving results. This orientation favors entrepreneurship. Family and work are not separate spheres of life in a pragmatic society, and family businesses are often created. Time is treated as an important resource that should be best utilized. Hence career development in this kind of society is more widespread than in a short-term culture (Mazur, 2013). The impact of a particular orientation on the professional career of an individual is presented in Table 2.24.

Poland and China, with scores of 29 and 24, respectively, belong to restrained societies, which is associated with a tendency to pessimism, with less sense of happiness and health. Such societies are characterized by sharp moral discipline and a tendency to be prudent. Free time for their members is not of particular interest, professional ethics is important. Modesty is considered one of the basic values, and the realization of one’s own dreams and desires is seen as unnecessary.

Table 2.24. Long- and short-term orientation versus professional career

Short-term orientation	Long-term orientation
<ul style="list-style-type: none"> • focus on an individual, achievements, freedom of action as basic work-related values • the importance of time off from work • important ongoing benefits • mental separation of superiors and subordinates • compensation according to skills • loyalty depends on business needs 	<ul style="list-style-type: none"> • learning ability, integrity, adaptability and self-discipline as core, work-related values • common goals of superiors and subordinates • lack of acceptance for large social and economic differences • investing in permanent and long-term personal connection networks

Source: Author’s own research based on Hofstede & Hofstede (2007).

4.2. Orientation in the career of the students surveyed

The indicators for the nine career orientations identified by Igbaria and Baroudi (1993) were calculated as a mean of the responses to career orientation statements, rated by respondents on a scale of 1 to 5. The mean and standard deviations for all variables are presented in Table 2.25.

Table 2.25. Descriptive characteristics of respondents’ answers regarding career orientation

Career orientation	Poland		China	
	Mean	Standard deviation	Mean	Standard deviation
Technical competences	3.98	0.93	3.73	0.98
Managerial competences	3.92	0.88	3.35	1.02
Autonomy and independence	3.64	1.05	3.06	1.03
Stability of employment	4.10	0.95	3.73	0.99
Geographic security	3.27	1.02	3.25	1.1
Creative entrepreneurship	3.56	1.14	2.94	0.99
Services and dedication to the case	3.68	0.95	3.12	1.09
Challenge	3.37	1.05	2.89	1.07
Lifestyle	3.83	0.90	3.35	1.14

Source: Own study based on research results.

The research shows that students in both countries are most interested in pursuing a career with one employer – they are job-oriented, which ensures their employment stability (a mean of for Poland was 4.1, for China 3.73). The results confirm the strong tendency of Polish students to avoid uncertainty. At the same time, they do not confirm the results of the assessment of Chinese society culture on the example of the studied group. Lubrinska (2016) formulates different

observations in this area – the results for stability and security (including geographical stability) were the lowest-rated anchor by young adults.

For respondents, it is also very important to confirm their own mastery in a specific field, competences development, striving for horizontal promotion – in the case of students from China, this issue is as significant as loyalty to the employer. On the other hand, the result obtained for Polish students in terms of technical competence is lower than for job security (a mean of 3.98). Extensive knowledge and skills, especially linguistic ones and computer equipment support, are the advantages of the modern young generation (Gajdzik, 2016), whose representatives value primarily opportunities for professional development (Brdulak, 2014; Mazurkiewicz & Moczulska, 2014). Striving to raise competences and the use the individual's potential are manifestations of collectivism, which confirms the characteristics of representatives of Chinese society, while in the case of the Polish respondents it proves the importance of collectivism for them. At the same time, it indicates the perception of the role of experts in professional life, which reflects the desire to avoid uncertainty.

Subsequently, Chinese students are interested in geographical stability (a mean of 3.25), which is the area of least interest for students from Poland. These results prove that the Chinese are seeking to stabilize their lives in geographical terms, and they settle in a specific region. Unlike the Poles, who indicate greater preferences in terms of mobility, and do not want to give up on the movements proposed by the employer. This observation confirms the moderate individuality of Polish society because the respondents are interested in mobility, but of an internal nature – within the organization.

Managerial competencies (a mean of 3.92 and 3.35 for Poland and China) and lifestyle (a mean of 3.85 and 3.35, respectively) are less important for students. This means that respondents highly evaluate their interpersonal, leadership, and emotional skills, as well as the skills of organizing their own work and teamwork, which is confirmed by the results of research among young people carried out by Lubrańska (2016) and Stachowska (2012). Striving to maintain a balance between various aspects of life, especially professional and personal life, is associated with the expectation of flexible working hours and mobility. The need for free time is characteristic of individualistic societies, such as Poland, while in the case of representatives of Chinese society, a positive attitude towards inaction reflects a weak avoidance of uncertainty.

Other determinants of the respondents' careers are services and dedication to the case (a mean of 3.68 and 3.12) as well as autonomy and independence (a mean of 3.64 and 3.06). Students have moderate social needs and are not overly interested in socially useful activities. They are oriented primarily to professional success. They do not strive excessively for an independent action related to responsibility for venturing into activities, which can be explained by

the need to gain professional experience, necessary knowledge, and skills. This means that the work of an independent specialist is only suitable for some of them. Both surveyed groups prefer specific rules of career development and feel the need to formalize, which reflects the distance to power and the desire to avoid uncertainty. For students from China, the results obtained are in contradiction to weak uncertainty avoidance characterized by this nation's culture.

Respondents, to a moderate degree, feel the need for creativity and the development of new things. They are not overly interested in solving non-standard problems, initiating changes, or taking calculated risks – the average scores for entrepreneurial creativity were 3.56 for students from Poland and 2.94 for students from China. The results do not coincide with the characteristics of representatives of the young generation, according to which they should be interested in change and innovation (Stachowska, 2012). The respondents are moderately oriented towards competition, taking risks, searching for new solutions, overcoming barriers and restrictions, which are confirmed by low ratings of the factor of challenges (a mean of 3.37 for Polish students and 2.89 for students from China, which is the lowest). The outcomes confirm the strong tendency of Polish students to avoid uncertainty, as well as their focus on quick results. At the same time, they contradict the poor uncertainty avoidance by representatives of Chinese society and their long-term orientation. A greater focus on the challenges of Polish students indicates a greater individuality of the group when compared to students of Chinese descent. The significance of challenges for young people from Poland also results from the studies by Lubrańska (2016).

The standard deviation outcomes confirm the value of the average rating for each of the anchors – there is a large convergence of answers given by respondents. The difference is most noticeable in the case of entrepreneurship in the group of respondents from Poland – the standard deviation of 1.14 means that the answers given are different from the average rating of 3.56 for this orientation. Therefore, the sample consisted of people who were strongly oriented towards entrepreneurial activity and those who were not interested in it. On the other hand, the most sizeable difference in respondents from China was their opinions on the harmony of private and professional life (standard deviation 1.14).

The analysis of the empirical research results is the basis for the conclusion that the values preferred by the respondents are strongly associated with the stage of their personality development, where an interest in satisfying basic needs (physiological and safety) dominates, along with changes in personal life, and with preparation for new social roles (a spouse, a parent). The significance of work, and an approach to a professional career, changes with the human life cycle – age and experience (Czarnota-Bojarska & Łada, 2004;

Kalinowski, 2010). The conclusions are in line with the periodization of professional development – the concepts of Webber (1996), Feldman (1988, after Jamka, 2000), Super (1980), Pocztowski (2008). Each phase of this development has different values – in the case of young people, work should provide development opportunities, experience, and be a source of satisfaction.

The final stage of the study was to determine the correlation relationships between nine career orientations, for which Pearson's linear correlation coefficient was used (Table 2.26).

There are correlation relationships between individual orientations in a career, which can be described as low or weak, and in some cases moderate. The strongest relationship is observed between technical competences and employment stability (correlation coefficient 0.58), followed by technical competences and managerial competences (correlation 0.53) and lifestyle (correlation coefficient 0.50). The weakest (negative at the same time) relationship exists between geographical security and employment stability (correlation coefficient -0.02). It should be noted that for most of the relationships correlation coefficients are statistically significant.

5. Conclusion

The purpose of the article was to determine the importance of national culture in professional career management. The empirical research focused on the characteristics of the national culture of Poland and China, taking into account the professional aspect and identifying the favored values for the professional careers of students of Economics in these countries.

The research shows that both Poland and China belong to countries that accept inequalities between people and they are characterized by masculinity and restraint. However, both countries differ significantly in their approach to interpersonal relationships, uncertainty and long-term relationships. This means that specific rules are expected in the career management process. The application of procedures and formal regulations leaves no room for emotions. Career is associated in particular with vertical promotion (which especially applies to Chinese society), its implementation is expected above all from men, and professional success is achieved at the expense of family and free time – the material issues are of significance. Individual achievements are an important criterion for further development. Ethics at work is also important.

Polish employees “work” for professional success primarily by themselves and it is important for them to achieve results in a short time, but safety is the basic motivating factor. In China, care for group harmony is important, and there are emotional ties between members. Long-lasting personal connections and entrepreneurship play an important role.

Table 2.26. Matrix of calculated linear correlation coefficients for career orientation

Career orientation	Technical competence	Managerial competence	Autonomy	Job security	Geographical security	Entrepreneurship	Dedication to the case	Pure challenge	Life-style integration
Technical competences	1.00	0.53*	0.31*	0.58*	0.11	0.27*	0.40*	0.35*	0.50*
Managerial competences	0.53*	1.00	0.28*	0.49*	0.28*	0.39*	0.47*	0.30*	0.43*
Autonomy	0.31*	0.28*	1.00	0.33*	0.17	0.37*	0.44*	0.46*	0.37*
Employment stability	0.58*	0.49*	0.33*	1.00	-0.02	0.19	0.22	0.19	0.37*
Geographical security	0.11	0.28*	0.17	-0.02	1.00	0.35*	0.32*	0.24*	0.22*
Entrepreneurship	0.27*	0.39*	0.37*	0.19	0.35*	1.00	0.29*	0.47*	0.15*
Dedication to the case	0.40*	0.47*	0.44*	0.22*	0.32*	0.29*	1.00	0.35*	0.47*
Pure challenge	0.35*	0.30*	0.46*	0.19	0.24*	0.47*	0.35*	1.00	0.22*
Lifestyle	0.50*	0.43*	0.37*	0.37*	0.22*	0.15*	0.47*	0.22*	1.00

Note: * statistically significant correlation coefficient values at the significance level α 0.05.
 Source: Own study based on research results.

The results of the surveys on career orientation show that respondents who had just started their careers, regardless of their nationality, value almost the same virtues – individual anchors were assessed by them in a similar way. For young people, stability of employment and opportunities for competence development are the most important. Vertical promotion and a balance between work and private life are slightly less relevant. An activity going beyond work, entrepreneurship and independence is rated lower. The difference in the assessment concerned the challenges that are more important for Polish respondents, while for Chinese students, geographical stability is more significant.

The research confirms that cultural factors play an important role in the decisions taken by an individual – national culture shapes values that are important in a professional sphere and this affects the favored type of career. In many cases, relationships between national culture and career orientations are observed. At the same time, the opinions of Chinese students, especially, do not confirm in certain cases the characteristics of cultural patterns made by Hofstede and associates. Cultural differences are clearly reflected in the level of ratings given to individual statements in the survey – respondents from China rated their preferences by 0.44 degrees lower compared to the respondents from Poland. This proves the greater restrictiveness of the Chinese national culture, where modesty is the main advantage.

The results suggest that cultural factors complement other aspects (including personality, biological, social, institutional, economic, and organizational ones) affecting career management. Based on the research, it can be assumed that national culture appears rather as a moderator between contextual factors and career orientations. However, to confirm this, further research needs to be conducted.

Knowledge of the features of national cultures that can evolve in the context of transformations makes it easier to understand society. At the same time, cultural patterns do not cover all features, which may lead to simplifications in interpretation or the creation of stereotypes (Rozkwitalska, 2008).

Knowledge about students' preferences regarding their careers is valuable for employers as it allows them to predict their choices and actions. At the same time, it forms the basis for creating conditions that enable career development in an organization – the selection of the right profession or a type of work, as a result of which an employee receives the chance of professional success and job satisfaction (Jamka, 2000, after Kalinowski 2010). It also provides employees with arguments enabling them to make decisions regarding further orientation of their professional development.

The research indicates the intentions and motivations necessary to take an action. They do not focus on the results of this activity concerning the course of their professional career. They also do not take into account other

cultural conditions that may affect the respondents' answers. It would be beneficial to broaden the research by further factors (regarding an individual, an organization, and those of a macroeconomic nature).

The research was conducted on a small sample – a group of Economics students from two academic centers, which is a limitation and does not create grounds for generalizing the results obtained on the society of the countries under the study. At the same time, the advantage is their focus on a culturally homogeneous region with a smaller geographical scope than the country. Therefore, in further research, it would be valuable to assess the culture of a given region, which would be a more reliable basis to formulate conclusions.

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Biographical note

Anna Mazurkiewicz, Doctor of Economics in Management Sciences, Assistant Professor at the Faculty of Economics at the University of Rzeszow. Her scientific interests are centered on issues related to talented staff management and career management. She is the author of several scientific publications on management, especially regarding the importance of human capital in contemporary organizations.

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Economic aspects of scientific projects at a public university

Joanna Kowalik¹

Abstract

The aim of this article is to describe the economic aspects of scientific projects based on the example of the project “Healthy Students” within the framework of the program “Small Grants for Sustainable Development,” co-financed by the Ecological Association EKO-UNIA. The aims, essence, and importance of scientific projects will be presented in this article. The types, parameters and elements necessary to maintain the economic aspects of scientific projects were presented. The study is based on the results of a survey, focus interviews, and a literature review. The research goal of the article was to evaluate the economic aspects of scientific projects based on the example of the “Healthy Students” project and the answers received from respondents, and the author’s own experience. The research has contributed to the formulation of the research objective: Are there any economic aspects of research projects stemming from a project co-financed by the Ecological Association “EKO-UNIA”? Referring to the presented research problem, the author adopted the hypothesis that there are economic aspects of scientific projects as supported by the example of the project “Healthy Students.” The results of the research allowed the author to verify the research hypothesis. The subjective scope of assessment covered students from the West Pomeranian Province. Economic aspects of scientific projects were the subject of evaluation. To obtain empirical data, a questionnaire consisting of twenty-five single- and multiple-choice questions was used, and was conducted on a target group of students from the West Pomeranian Province to verify accuracy of the research hypothesis. The results of this study show that, according to students, scientific projects have economic aspects, and that it is worthwhile to participate in such initiatives. The choice of this area of interest results from the fact that currently issues connected with applying for co-financing from various institutions, i.e. NCN, NCBR, Ministry

¹ Joanna Kowalik, M.A., Institute of Economics and Finance, Faculty of Economics, Finance and Management, University of Szczecin, 64 Mickiewicza, 70- 001, Szczecin, Poland, e-mail: joanna.kowalik@usz.edu.pl (ORCID ID: 0000-0002-5152-554X).

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of Science and Higher Education and various associations, are of increasing importance for and are widely discussed by scientific entities (universities).

Keywords: *projects, economics, universities*

1. Introduction

In an era of globalization and a changing market environment, not only are companies forced to compete more and more aggressively but also academic institutions, e.g. universities must adapt to changes in the higher education market. This is due to the fact that effective sustainment of an advantage determines the way a given institution is managed and the need to introduce innovative solutions related to its core business. Therefore, most universities nowadays strive to obtain funds from various institutions, i.e. National Centre for Research and Development (NCBR), National Science Centre (NCN), Ministry of Science and Higher Education (MNiSW) or associations, to further scientific development of a given entity, maintain or improve the quality of education or at least enhance its competitive position in the higher education market. However, now that universities compete for students, the key task is to raise funds to meet the needs of the students. The implementation of projects or grants should bring shared economic benefits, both for the student and the project team responsible for the whole task. The European Union allocates a budget to Poland, whose aim is to support the development of science for both the economy and higher education. The obtained financial resources allow institutions to enrich and expand their educational offer and co-finance scientific research for academic teachers, this being the basis for the development of a given institution, both due to their research work on developing innovative educational programs and the extensive possibilities for publishing scientific research results supporting the economy. However, not every funding application will be positively considered by the commission and receive funding for the intended objectives. Likewise, not every project succeeds and achieves the desired results due to multiple unfulfilled activities, which must be closely linked to one another. If this is the case, one can only wonder how all projects are implemented because the types, parameters and elements necessary to maintain the economic aspects of scientific projects are of crucial importance.

The aim of the article was to assess the economic aspects of scientific projects at a public university based on the example of the “Healthy Students” project supported by the answers received from the respondents and the author’s own experience. The aim of the study was to identify economic benefits gained by students participating in scientific projects. According to

the research, there are many economic benefits gained by students engaged in scientific projects undertaken by universities, which include gaining new information and broadening knowledge, the possibility of getting a dream job, team cooperation, receiving a certificate, experience for the future, a valuable entry in a CV, and working with lecturers. At the same time, the project team achieves satisfaction with the realization of the assumed project goals and filling in the project indicators, which in turn leads to proper project settlement. The most important goal for any public university is to develop students' competences through involvement in scientific projects.

2. Literature background

At the beginning of the considerations in this section, particular attention should be paid to the classification of economic sciences. According to the Regulation of the Minister of Science and Higher Education of 20 September 2018, a new two-stage division into fields and disciplines was introduced. In accordance with this regulation, from 2018 on, the social sciences include scientific disciplines like economics and finance, as well as management and quality sciences. Therefore, the discipline of economic sciences falls within the field of social sciences. Therefore, Robbins, in his study, considers that economics is a discipline where the focus is on 'human behavior as a relationship between ends and scarce means which have alternative uses' (Robbins, 1933, pp. 5-23).

In the subject literature, many definitions of a project can be found. However, it is also important to distinguish between a project and project management. In his dissertation, Kacuga explains, from the management standpoint, that 'the project is a planned framework of activities within a certain period to achieve a set goal (...) the project represents a problem for which a solution has been planned' (Kacuga, 2008, p. 13). A project is the creation of something innovative or different, which will distinguish it from the rest of the teams and people applying for funding. The most important issue is to plan its beginning and end, assuming that all planned undertakings are spread out in time, to create a unique result or product or service. Therefore, the project is unique because it consists of time-planned and interconnected activities aimed at achieving high-quality results within a multitude of resources and defined costs (Black, 2009). Whereas, Grucza insists that, apart from its uniqueness, a fixed time frame, a fixed beginning and end, and the involvement of limited financial resources, a project is also highly complex because it is carried out by the project team of qualified specialists from various scientific fields. Thus, a project involves organizational, technical and economic risks, whereas the implementation and preparation of the project itself requires knowledge, time, willingness, and special methods (Grucza, 2012).

Generally speaking, the project is a set of activities that are characterized by such features as (Kuck, 2014, p. 4):

- a fixed beginning and end;
- a complex interconnection;
- an aim to achieve a certain goal by creating something unique i.e. a product, service or result;
- organized sequences of activities;
- achieving the desired result;
- most often realized by the project team.

Burton and Michael (1999) consider that project management is the process by which the project manager should plan and manage all the tasks within the project using the resources provided by the organization for the implementation of the project. The authors also state that project management is the skillful use of available techniques to achieve the intended results, which are in line with the standards set within a given time and budget. Project management is also defined as an area of management that deals with the applicability of available knowledge, skills, methods and tools with the aim of achieving the project objectives, i.e. the quality of the intended result within a certain time and cost frame (Brilman, 2002). Whereas the Project Management Institute (PMI, 2013) defines project management as the application of skills, knowledge, tools and techniques to satisfy and even exceed the expectations and needs of the stakeholders involved in the project (Mingus, 2009). It is noticeable that a more extensive interpretation of project management presented by the Project Management Institute concerns various types of projects, which include educational, research, and scientific projects, and implementation or business projects. In addition to defining all the objectives of a given project, it is also essential to manage the necessary resources in an efficient and effective manner (Pawlak, 2006). Project management and applying for funding from external sources require extensive interdisciplinary knowledge, management skills, creativity and organizational excellence from the beneficiaries. However, the most important issue is how the project is managed, as it depends on three important parameters, including time, resources and quality (Webster & Knutson, 2005). Therefore, project management is a continuous process in which the person in charge of the project carries out targeted control and planning of the tasks within the project and allocates funds accordingly, using the appropriate methods to achieve the desired objectives at the set costs (Jędrych et al., 2012). From the perspective of the social sciences, Zieleniewski (1981) is of the opinion that a truly effective activity leads to the minimum effect of the intended objective, whereas the extent of achievement of the objective is considered the measure of effectiveness. Thus, when referring to projects, effectiveness is gradual due to the gradual nature of the objectives and

the principle of milestones towards the main objective. In his study, Bielski takes the view that effectiveness should be assessed by the achievement of the intended objectives (as it corresponds to the English term *effectiveness*), and then the level of using all possible resources (as it corresponds to the English term *efficiency*). Hence, the concept of effectiveness in Polish literature is often replaced by the concept of efficiency (Bielski, 1997). Concluding, Zieleniewski believes that efficiency means the parallel occurrence of effectiveness, efficiency and cost-effectiveness.

From her own experience, the author is of the opinion that the project should, first of all, have a title, to which the main objective, specific objectives, and the whole concept should be adjusted. Appropriate staff should also be selected to manage the project, giving the managerial functions accordingly. It is also necessary to create a team of people who will support and add value to the project. Besides the objectives, it is crucial to assess the effectiveness of the project, which is possible through the development of both output and performance indicators. Output indicators usually refer to all the outputs that are produced during the project implementation that should not exceed the adopted deadlines for the implementation of the project. Performance indicators, however, relate to the effects of activities that should be visible upon completion of a given project. The performance indicators should be presented after the output indicators, as the performance must be coherent and logically linked to the output. Developing an innovative solution allows the applicant to stand out from the competition and, additionally, has a positive impact on the promotion of the entity that implements the project. It is crucial that the project has a properly selected management and team, as all persons actively participating in the implementation of the planned activities must have pre-defined and specified tasks to perform. The project is more effective when it is carried out as teamwork because each person can support others through their experience. The most important aspect of achieving the project aim is the target group, i.e. determining the number of people to whom the project offer will be addressed, assuming that the number will be achieved as the final result. Each project should lead to exceptional and unique success and generate profit for the unit, as well as resulting in the implementation of new changes in the daily behavior of employees. The changes should have a direct impact on the economic indicators and allow obtaining specific, measurable, and additional business value for the organization (Wysocki, 2013).

3. Research approach and methods

To characterize the concept of a project, its development and research activities must first be defined. Both areas of activity are reflected in the

category of development and research, which are understood as (Gryzik & Knapińska, 2012):

- seeking both truth (research) and usefulness (development);
- obtaining new knowledge (research) and using it to achieve various effects, e.g. equipment (development).

According to Statistics Poland (GUS, 2020), research and development activity includes three types of research, namely:

- 1) **Fundamental research** – experimental or theoretical work; its aim is to gain new knowledge about the fundamentals of phenomena and the observed facts, leaving aside its practical application.
- 2) **Industrial or applied research** – aimed at the acquisition of new knowledge and skills for developing new products, processes, or services through the creation of components of complex systems upon which the suitability of generic technologies is assessed, excluding prototypes within the scope of development works.
- 3) **Development work** – including the acquisition, combining, shaping and using of available knowledge and skills from the fields of science, technology, business, and other fields for the purpose of production planning and creating and designing new, altered or improved products, processes and services, disregarding, however, routine and periodic changes introduced to products, production lines, manufacturing processes, existing services and operations in progress, even if these are considered improvements.

Classic academic R&D projects are nothing more than the verification of scientific theories or concepts to be applied in practice. Due to the essence of the work and the final results, projects can be divided into “soft” and “hard” projects (Kisielnicki, 2018, p. 31):

- “soft” projects are those whose implementation involves the presentation of computer or semantic models, all statements, reports and publications that are related to the discovery of new elements of the real world in the process of improvement, streamlining, refining, patenting, methodology or technology. According to the value chain, the result of “soft” projects is further research and development projects, which in turn result in new discoveries, concepts, hypotheses or theories;
- “hard” projects are those that aim at a well-defined product presented as a finished product or design. Depending on the value chain, the result is a prototype refined in subsequent projects and introduced into mass production.

Kisielnicki (2018) presents the structure of the project pyramid, in which the involvement of intellectual capital in project implementation is considered the basis of the typology, as it is the strongest in the phase of scientific projects and the weakest in the phase of implementation projects. However,

considering economic practice and the involvement of financial resources in the implementation of a given project, they are strongest in the implementation phase and weakest in the phase of scientific projects. Therefore, the pyramid of funds involved in economic practice is reversed when compared to the situation presented in Figure 2.15.

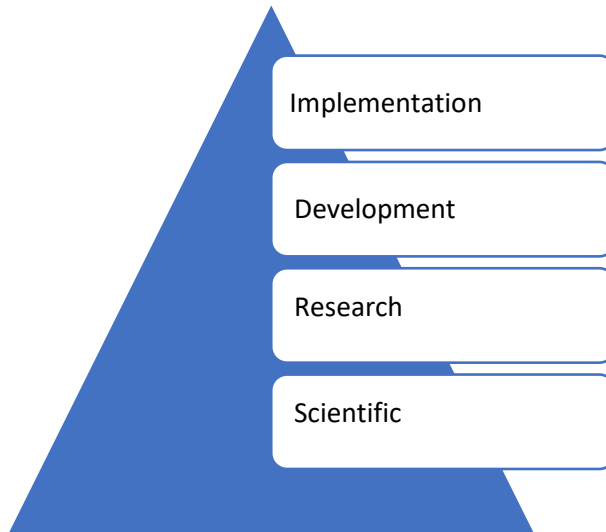


Figure 2.15. Project pyramid

Source: Kisielnicki (2018).

Owing to the commonness of the terminology used in the subject literature, the two middle types of projects, i.e. research and development, were combined into one common type. The term of research and development projects is commonly used in documents that refer to programs funded by the European Union and government agencies. The terminology also refers to activities in undertakings of a scientific and scientific-technical nature, as well as activities aimed at implementing strategies in different types of organizations and development. R&D projects are defined as complex ventures implemented by a team of employees who are referred to as researchers (Kisielnicki, 2013). The projects usually involve the analysis of the relationship that occurs in a selected area of reality. Such projects are an open system of activities, as all relations and elements are subject to an in-depth analysis.

The subject literature also offers several other classifications, of which the best known and commonly used is the typology described by Trocki; according to his work, projects are divided into scientific and research

projects, and development projects (Trocki, 2012); that is, the two lowest tiers of the project pyramid. The key difference between the types of projects is that research projects primarily aim to introduce a new product or new technology into practice, while scientific and research projects are focused on creating new knowledge. Nevertheless, the proposed division is disputable, as all types of projects overlap as they are usually realized in different economic, legal and social environments, and the relationship between the project and the environment is of different nature. A combination of a research and development project results in an R&D project, which can also be thought of as a scientific research project (Mesjasz-Lech & Grabowska, n.d., p. 9):

- being the product or the result of a report, model or written work (e.g., for an academic degree);
- being the intended undertaking of a specific group of persons, e.g. a scientific team;
- having an attribute meaning (e.g., as in the statement “the project implementation is on a very good level”).

Such a project is usually understood as a system of activities defined by the limits of the project (its purpose and scope), the deadlines for implementation (the time), people, and tangible or information goods, or the capital necessary for its implementation (resources). Hence, it is important to establish a methodology for managing research projects, which is possible by defining five project parameters (Wysocki, 2005, pp. 47- 60):

- the scope – contains information on what will and will not be done, providing a basis for further work on the project; it also happens that during the project implementation its scope undergoes unplanned changes that are a challenge for the project manager and thus it is necessary to detect these changes to align all activities with them;
- the quality – refers to two categories: product quality, i.e. the quality of the outcomes of the project implementation, where the product means intangibles or devices, etc.; and the process quality, i.e. the project management process, where the most important is the efficiency and effectiveness of the process;
- the costs – represent the total budget of the project and are expressed in monetary units; they have a significant function in the project as they usually pertain directly to the results of the project, e.g. by generating sales revenue,
- the time – is a valuable resource, since regardless of how it is used, it flows inexorably; when creating projects, the time should be used as efficiently as possible as it cannot be stockpiled; in fact, it is from the date of commencement of work that the struggle with time begins to complete the project in the adopted schedule; it is possible to curb the time of project implementation, however, this involves increasing the resources, which in turn increases costs;

- the resources – are the most important element in planning the entire project since their selection influences the success or failure of the project; it is usually possible to use the unit’s own resources, but one can also try to obtain them from outside. Resources are grouped according to: human resources, capital resources (materials, real estate, equipment), information resources (collected information necessary for the decision-making process), and technological resources (knowledge, e.g. licenses or patents).

Young’s (2007) research results show that the success of the project is influenced by such elements as:

- appropriate communication in the project;
- a well-chosen project team, in particular employees, e.g. researchers with the necessary professional qualifications, i.e. the apt skills and knowledge to perform particular tasks;
- a correctly drawn up project plan and schedule, the proper allocation of all responsibilities and tasks;
- a precise definition of project objectives, resources, and parameters (indicators);
- project must be subject to regular controlling and monitoring to avoid potential risks;
- timely and reliable reporting of the progress of project work;
- addressing any problems at managerial level on an ongoing basis;
- maintaining continuous relations with the stakeholders (individuals, organizations, institutions, offices) to provide them with information on the course of project implementation.

It should be admitted that Young’s statement is accurate, as the elements above positively influence the implementation of scientific projects or grants, as they are also economically beneficial for both sides – for the student and the project team responsible for the project.

According to the presented literature, the “Healthy Students” grant can be classified as a scientific research project, given that it was an intended action of a specific group of people (a scientific team) and is a product (a result) presented in the form of a report as well as the result of written works. The author tested the correctness of the hypothesis by means of a survey performed on a group of economics students from the West Pomeranian Province. The aim of the article was accomplished by obtaining answers from respondents who filled in the prepared questionnaires. The analysis of the target group shows that the representativeness of the research sample is low. However, it is a result of the number of economics students. The choice of the field of study for the verification of the correctness of the hypothesis was deliberately applied to a given research group because it is the leading field of study in a given research unit. In addition, it is also an encouragement to undertake further

research aimed at assessing the economic aspects of scientific projects at any public university in order to broaden the knowledge about the benefits. The effectiveness of the project was assessed based on output and result indicators. The indicators are always based on baseline and target values of the indicator, which are expressed by numerical values, constituting the economic indicators of projects. The results of the conducted research show that, according to the students' opinion, scientific projects do have economic aspects and that it is worthwhile participating in such initiatives as they bring pure benefits.

4. Results and discussion

The aim of the research is to assess the economic aspects of scientific projects based on the example of the "Healthy Students" project and on the answers obtained from the respondents and the author's own experience. The data for evaluation were collected on the basis of a survey and focus interviews. It is necessary to select correctly a number of focus group participants. It usually depends on the subject matter of the study and the total number of focus groups participating in a given research project. Babbi (2005) maintains that the number of people taking part in an interview should be correlated with the research topic, and may range from 12 to 15 people. Therefore, a group interview was conducted on a representative group of scientists from the unit implementing the project (13 people) forming the Competition Jury. The aim was to ascertain the employees' opinions on the implementation of projects, as well as the evaluation of projects among students. The scope of assessment covers students from the West Pomeranian Province. The time range covered the period from April 1st to June 1st, 2019, i.e. after the project was completed, the interviews were conducted and the author prepared a questionnaire for students and gathered their feedback. The output indicator referred to the number of participants in the project implementation, which was verified by means of application forms for students' admission to the project, their recruitment and the final report prepared by the beneficiary. On the other hand, the result indicator referred to the number of people who improved their competences within the university's activities, where the source of data was based on tracking participants' further development, a written report, and selection of a group.

The project "Healthy Students," within the framework of "Small Grants for Sustainable Development," was co-financed by the Ecological Association EKO-UNIA and was completed in 2018. The project led to the implementation of the current research and formed the basis for future cyclical initiatives in accordance with the already developed methodology. The main idea of the project was to promote healthy, balanced diets since a healthy lifestyle is no longer about an idea or fashion promoted by pop culture, but about practical

social, economic, and ecological benefits. Nowadays, most members of society, especially young people, do not pay attention to what they eat. However, it should be remembered that all organisms can only function properly when they are provided with nutritious ingredients. Moreover, enough movement but also enough rest is required as it is important for the proper physical and mental development of a person. The project was addressed to the student community and its task was to promote healthy food through posters or installations. Teams of two people, who applied for participation in the project, had to present their works by means of recycling. The posters (works) had to be prepared from recycled paper, plastic bottles, and any waste that can be reused. Recycling is one of the methods of environmental protection, which aims to reduce the consumption of natural resources and reusing waste materials. The principle of recycling is to maximize the reuse of waste materials, while minimizing processing inputs, thus protecting the natural raw materials used for production and the raw materials used for post-processing. Therefore, these activities have brought social, economic, and environmental benefits.

The aim of the project was to popularize the sustainable development principle concerning healthy food, and to deepen students' awareness of a healthy lifestyle in social (communication), ecological (sustainable development), and economic (research) terms. The project aimed at integration leading to a balance between the basic elements of the system shaping the future of people on the Earth, i.e.: environment, society and economy, so that the development of one of the elements would not pose a threat to the others. The Competition Jury formed by the researchers selected the winners through voting. The winners of the 1st, 2nd, and 3rd places received financial vouchers worth PLN 450, 350, and 200, respectively. The author of the paper conducted focus interviews to identify the cognitive gap between the needs and expectations for further cooperation between scholars and students. The interviews were conducted with 13 academics and a group of students. The aim of the qualitative research was to raise the awareness of the existing cooperation of young people with scholars and to devise future plans to create a cyclical project initiative. The project participants responded to questions about the competences they would like to develop or acquire that would be necessary for their future educational choices. In the survey, twenty-five respondents stated it was helpful to have additional experience acquired throughout their active participation in the project, and the preparation of lecturers who promote additional activities, stimulating students' cognitive curiosity. The respondents also pointed out that soft skills are a helpful factor, e.g. interaction between peers from different centers, making new friends, cooperating or working in groups, motivation for further action. In the study, 13 members of the research staff (100%) answered that they would like to continue cooperation with students in the future, as this

gives the opportunity to develop further joint and innovative projects that are also the source for scientific work. The research staff — due to the considerable interest of students in such activities — attempted further teamwork on other initiatives aimed at students.

The survey consisted of twenty-five single- and multiple-choice questions. The survey was attended by a target group of thirty students from the West Pomeranian Province. The characteristics of the research sample are presented in Table 2.27. The respondents answered all the questions included in the questionnaire; however, for the sake of clarity of presentation, only the most important information was presented in the diagrams.

Table 2.27. Study group structure

Sex - No.	Education	Place of residence
Female - 14	University - 0	Large city (over 500k) - 2
Male - 16	Secondary - 30	City (101- 500k) - 5
	Vocational - 0	Town (50-100k) - 8
	Elementary - 0	Rural areas - 15
Age - No.	Field of study	Type of studies
18 - 20 y/o - 21	Economics - 30	First-cycle studies - 30
21 - 25 y/o - 9	Management - 0	Second-cycle studies - 0
26 - 30 y/o - 0	Accounting and Finance - 0	Third-cycle studies - 0
31 - 35 y/o - 0		Extramural studies - 0
35 + y/o - 0		

In total, thirty students from the West Pomeranian Province, sixteen men and fourteen women participated in the study. Gender proportions in a given study group are almost evenly distributed. The majority in the target group were respondents between 18–20 years of age (21 persons) and 21–25 years of age (9 persons). The research shows that all participants of the survey have secondary education, which is consistent with the students' answers, as the age of the students already indicates the first-cycle studies. The research shows that half of the respondents (50%) live in rural areas; however, during their studies, they are staying in Szczecin. The research was carried out on full-time first-cycle studies in Economics.

An important issue raised in the survey was a question about what motivated the student to study Economics. The respondents expressed their opinion by marking the answer that would best define their choice. The X-axis presents opinions according to the highest number of choices made by students, while the Y-axis presents the students' answers.

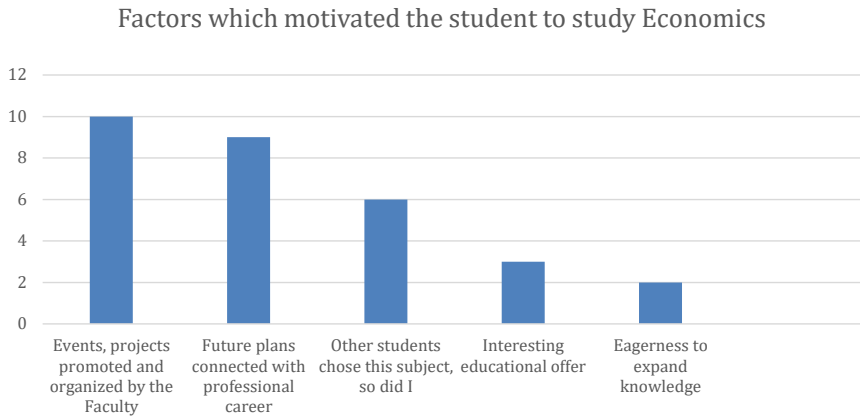


Figure 2.16. What motivated you to study Economics?

As can be seen from Figure 2.16, most students (10 participants) chose Economics because events and various projects organized by the Faculty were well promoted. Perhaps this is due to marketing activities in social media, where a given research unit has its own profile to promote the University, and this, in turn, attracts more attention from young people. Nine respondents (30%) decided that future plans related to their professional career were important to them. Six participants decided that they had chosen this faculty because they followed the choice of other people. For only two people, the main reason was to broaden their knowledge, and for three people the choice was due to an attractive educational offer. The results revealed that 12 out of 30 respondents already worked (40%) while starting Economics studies. However, for most respondents (9 people) this was not work related to future professional plans, and neither was it connected with the choice of a field of study. Twenty-five respondents stated that they had already had the opportunity to take part in scientific projects carried out by the Faculty and would use it again at the earliest opportunity. Therefore, only this section of people could answer the subsequent question. Further on, when asked to provide information on what motivated them to take part in the projects, the respondents declared they were primarily curious about the subject matter (8 people), there were no classes conducted at that time (4 people), it was possible to obtain a certificate (5 people), gain additional experience (6 people) and knowledge (2 people). Responding to the questions, the respondents also had the opportunity to express their opinion on the information provided by the lecturers; this question directly concerned the “Healthy Students” project, namely whether the research staff informed the students about the implementation of the grant

at the Faculty and its benefits. The results showed that 100% (30 people) of the respondents were provided with such information and were encouraged to participate in subsequent initiatives and were presented with the benefits of being involved in projects. Economics students stated almost unanimously (29 people) that the information provided on the “Healthy Students” project motivated them to take part in other future projects. Due to the information and promotional campaign, the news reached a wider audience. After the previously presented information about the project, the survey included a question in which the participants could also express their opinion, indicating the factors encouraging them to become active in scientific projects. Students were to rank the given economic values at their own discretion on a scale from 1 to 10, with 1 being the highest value and 10 the smallest one. The figure below presents the values in the order chosen by the respondents on a scale from 1 to 10. The Y-axis presents the values in the order chosen by the respondents, and the X-axis shows the answers of the respondents.

Economic aspects of scientific projects

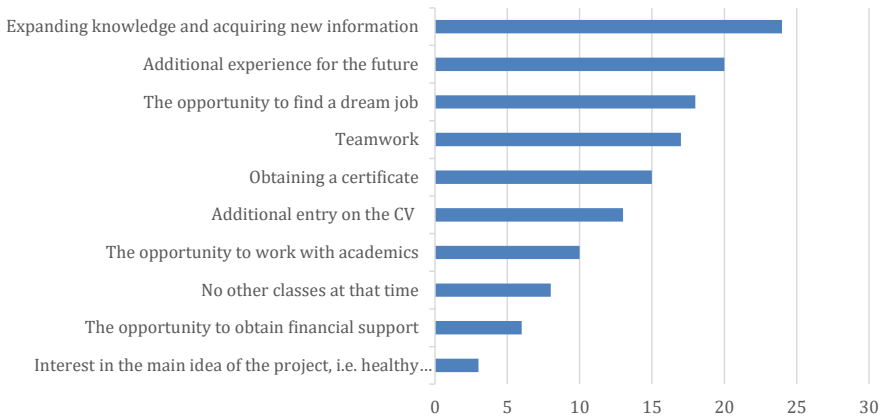


Figure 2.17. Economic aspects of scientific projects

According to Figure 2.17, the highest economic value for students related to participation in the project was the broadening of knowledge and gaining new information (24 people). For 67% (20 people) of the participants, another equally important aspect was gaining experience for the future. Another significant aspect for 18 respondents (60%) was the possibility of obtaining a future job of their dreams. Slightly less, because 17 participants consider teamwork in projects important as it gives the possibility to share

responsibilities. However, 10 people count on closer cooperation with lecturers, which can bring further reciprocal benefits, e.g. scientific publications or lectures at conferences, and these can, in turn, bring financial benefits to the students as they can apply for various scientific scholarships. The lowest economic value is attributed to the main idea of the project.

It is a great honor for universities to obtain funding from external sources, i.e. from NCN, NCBR, Ministry of Science and Higher Education, and various associations as part of competitions, as well as successful project implementation, as a given unit receives additional financial support for particular activities. This, in turn, largely contributes to:

- improving accessibility to higher education;
- raising competences of those participating in higher education, responding to the needs of the economy, the labor market and society;
- improving the accessibility to international educational programmes for higher education participant from Poland and for foreigners;
- support for the employees of universities undergoing restructuring processes as a result of university consolidation;
- supporting organizational changes and increasing the competence of staff in the higher education system.

The amount of funds received depends to a large extent on the opinion of an expert from an intermediary institution, but also on the concept of the originator and allocation of funds for given project tasks.

5. Conclusion

The scientific project “Healthy Students” within the framework of the “Small Grants for Sustainable Development” competition, co-financed by EKO-UNIA Ecological Association, in cooperation with the Association of Alumni and Friends of Economic Sciences, addressed to the student community of the University of Szczecin, has been successfully completed.

The presented research results gave the author the grounds to assume that economic aspects are mutually beneficial for both the student and the project team responsible for all the tasks. These included the following: positive values for the institution implementing the project and the satisfaction of students; human team activities; achieving the assumed project goal; settlement of costs in accordance with the assumptions; proper promotion; coordination and monitoring of project implementation; accounting; and proper communication in the project. The surveys and focus interviews showed that for students, the most important economic aspect is the desire to gain practical experience for the future, which, in turn, will certainly translate into financial benefits in the workplace. On the basis of the research, the author states that some

economic aspects of scientific projects are important for students, and thus, it is worthwhile to engage in such initiatives. All the author's assumptions concerning the hypothesis and the aim of the research have been achieved by means of the actions taken, intended, and implemented.

The world of science is constantly evolving, seeking new initiatives that create opportunities for broadening horizons, breaking down barriers, and providing common innovative solutions. Work and mutual support are always beneficial to both sides. Scientific projects are also grounded in various types of courses or educational training, allowing students to acquire useful knowledge or to add a new entry in their CVs, which attracts potential employers; projects give an opportunity to participate in internships in reputable companies with the perspective of developing further skills in the company. The participation in the project broadens horizons and increases knowledge; the participants, e.g. businesses, are also interested in supplementing the knowledge they have acquired at the university, whilst active involvement allows students to acquire practical skills and can confront the acquired knowledge with practice. Therefore, it is worth taking advantage of all the opportunities offered by universities in connection with participation in projects.

The results of this study may serve as an incentive to undertake further research on the evaluation of the economic aspects of scientific projects on a group of students for the purpose of research. The research has some limitations, resulting mainly from a small research group (30 people). However, it delivers valuable feedback on the implementation of projects and obtaining project funding.

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Biographical note

Joanna Kowalik – M.A., Institute of Economics and Finance, Faculty of Economics, Finance and Management University of Szczecin. Her scientific interests include economics of health, management in health care, economic analysis, project management, and the quality of work and life. In addition, she is a Ph.D. student in Economics. At the moment, she is working at the University of Szczecin, where she coordinates EU projects and is also an academic teacher.

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Chapter 3.
The intersections of policy
and management issues:
Governing networks and interests

Development of cooperation in localized cooperation networks: A comparative study of cluster organizations and technology parks

Anna Maria Lis¹

Abstract

The main aim of the paper is to analyze the level of development of cooperative relationships in localized cooperation networks – among enterprises associated with cluster organizations and park tenants. The author reports the findings from the quantitative study carried out in the selected cluster organizations and technology parks functioning in Poland. The basic method of data collection was a survey questionnaire. The research sample included 132 respondents from cluster enterprises and 137 from park tenants. In addition, a comparative analysis was conducted. The research is based on the original concept of the trajectory of development of cooperative relationships in cluster organizations. The current study focused on three main areas of inter-organizational cooperation: motivation, effectiveness, and commitment. The effectiveness of the surveyed enterprises in both groups should be assessed as quite low, while their attitude as passive. The study shows that the most common forms of cooperation are those assigned to the lowest level of cooperation – the surveyed enterprises achieved level I, regardless of their initial motivation. At this level, the surveyed enterprises also showed the greatest commitment. In contrast, it was the most difficult for them to achieve the highest level IV, which requires the highest level of commitment. The knowledge of the identified relationships among motivation, effectiveness, and commitment in cluster and park structures can help these organizations to take conscious actions aimed at developing cooperation among their members/tenants. The findings add to the state-of-the-art knowledge in the concept of industrial clusters, as they shed new light on cooperation developed within formally established organizations, based on geographical proximity, focused on the networking of their constituent companies.

Keywords: *cluster, cluster organization, science and technology park, industrial park, cooperation, commitment*

¹ Anna Maria Lis, Ph.D. Hab., Associate Professor, Department of Industrial Management, Gdańsk University of Technology, 11/12 Gabriela Narutowicza Street, 80-233 Gdansk, Poland, e-mail: Anna.Lis@zic.pg.gda.pl (ORCID ID: 0000-0002-1527-7796).

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1. Introduction

Geographical proximity is conducive to the development of inter-organizational cooperation. This is confirmed in many concepts of regional development, both the older ones, such as Marshall's industrial district (Marshall, 1890), as well as contemporary ones. These include Italian industrial district (Becattini, 2002; Bellandi, 2002; Pyke, Becattini, & Sengenberger, 1990; Sforzi, 2002), an innovative milieu (Aydalot, 1986; Maillat, 1998), learning region (Florida, 1995; Morgan, 1997), regional innovation system (Cooke, Uranga, & Etxebarria, 1997; Braczyk, Cooke, & Heidenreich, 1998), ecosystem of innovations (Adner & Kapoor, 2010; Autio & Thomas, 2014) as well as the concept of a cluster (Porter, 1998; 2000; 2008). The development of cooperation among companies in industries that exhibit a high degree of regional concentration is stimulated by agglomeration externalities. These are the benefits described by Marshall (1890), and confirmed by Arrow (1962) and Romer (1986), which include access to a rich pool of specialized workers, the emergence of specialized suppliers, providing easy access to intermediate inputs, as well as knowledge spillovers. Agglomeration externalities are – according to Schmitz and Nadvi – benefits that companies have without the intended effort to achieve them (Schmitz & Nadvi, 1999). They can be included in the category of passive collective efficiency, in contrast to intentional actions aimed at their creation through the cooperation of the involved entities, understood in the category of active collective efficiency (Schmitz & Nadvi, 1999; Caniels & Romijn, 2003). Active agglomeration benefits arise as a result of direct relationships among enterprises, developing within a value chain (Porter, 1985) or – looking even wider – within a value network (Nalebuff & Brandenburger, 1996). Coexistence in geographical proximity especially facilitates the development of relationships based on trust, which further encourages companies to enter into various systems of a formal and informal nature, facilitating the generation and transfer of tacit knowledge, which is difficult to transfer over long distances. Therefore, active cooperation among entities operating in geographical proximity is perceived as the main factor for achieving lasting competitiveness of the cluster and the region in which it develops.

The cluster concept, developed since the early nineties of the last century, is much more grounded than cluster organization (CO). In comparison to the cluster concept, the concept of a cluster organization is at an earlier level of development and the degree of its prevalence is incomparably smaller. The literature especially lacks publications that would describe the development of cooperation in COs. Given the existing research gap, the main aim of the paper is to analyze the level of development of cooperative relationships among companies grouped in localized cooperation networks. The main

research objects are selected cluster organizations and their members – cluster enterprises. However, to expand the research field, the study included entities from an additional comparative sample – technology parks and companies located there (park tenants). Parks have now become a global phenomenon. Their development began in the 1950s, first in the USA, then in other countries. The first parks in Europe began to appear in the 1980, while in Poland, the intensive development of these institutions occurred after 1989. In practice, there are many different forms of park structures, which is reflected in the variety of definitions presented in the literature (Link & Link, 2003). Various terms are used (often interchangeably) in the literature to describe this kind of institutions: science park, science and technology park, research park, industrial park, technopole. Although many authors highlight their distinctiveness (Chordá, 1996; Sternberg, 2004) and the disproportions of their dynamic nature (Phan, Siegel, & Wright, 2005), it is possible to distinguish a particular set of their common characteristics. These include the sophisticated cutting-edge infrastructure of the parks, formal and operational relations with R&D institutions, support for the creation and development of knowledge-based enterprises, and a management model that actively strengthens the transfer of technology and business skills of the park tenants (Colombo & Delmastro, 2002; Hommen, 2006).

The choice of technology parks for comparative analysis is due to their high similarity to cluster organizations. Park structures, like cluster organizations, are formally established organizations that operate in geographical proximity, in which clustering processes take place. Both concepts emphasize the significance of geographical proximity for the development of cooperation among entrepreneurs, who undertake their operations in conditions characteristic not only of the particular localization but also of the particular industry. Analyzing the development of cooperation among the enterprises being cluster members and park tenants can help increase knowledge of the mechanisms governing the cooperation of entities in geographical proximity. The additional cognitive value comes from the possibility of comparing both groups of entities.

The paper is organized in the following manner. At the beginning, a literature review concerning cooperation in cluster and park structures was carried out, which allowed the identification of a huge research gap. In the next step, the paper includes details with regard to the methodology. Then, it reports the empirical results. Finally, a discussion and conclusion are provided.

2. Literature review

2.1. Concept of cluster and cluster organization

The thread of cooperation is strongly emphasized in the concept of the cluster popularized by Porter. Porter defines clusters as “[...] geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate” (Porter, 2008, p. 213-214). This definition includes the most important cluster attributes, namely, geographical and sectoral concentration. Thus, the similarity of cluster enterprises results from the common location and sectoral affiliation. They share the same vision of regional and industrial development and, facing similar problems and threats, and they follow a common development trajectory. Geographical proximity is also the basis for the development of cooperation in clusters. The small distance between enterprises, but also other factors of common location (for example, cultural community, common language) favors establishing informal contacts with other entities. Numerous and repetitive interactions between partners can turn into lasting, trust-based business relationships. In turn, sectoral concentration facilitates the creation of various relationships, both vertical, along the value chain, and horizontal, often based on cooptation, which means cooperation and at the same time competition (Dagnino, Le Roy, Yami, & Czakon, 2008; Czakon, 2009; Cygler, 2009; Jankowska, 2012).

The issue of development of cooperation in industrial clusters is well described in the literature, taking into account the additional theories explaining the reasons for the development of inter-organizational relationships. These include the agglomeration theory (Scitovsky, 1954; Perroux, 1950; Krugman, 1998), the theory of transaction costs (Williamson, 1985), the theory of flexible specialization (Piore & Sabel, 1984; Sabel, 1989), the network approach (Cooke & Morgan, 1993; Johanson & Mattson, 1993), and the resource-based view (Wernerfelt, 1984; Mahoney & Pandian, 1992; Barney, 1991).

In the literature, much attention has been devoted to discussing the development of cluster cooperation through the prism of the cluster’s evolution or life cycle, which perfectly reflects the complex nature of the processes occurring within the cluster, among its elements. In typologies based on an evolutionary approach (van Dijk & Sverrisson, 2003), several development phases of the cluster are distinguished, from the lowest (local clusters) to the highest, and thus the most mature, focused on the development of innovation and cooperation (industrial district). In turn, according to the second approach based on the life cycle, the cluster changes with the observed

growth phases (Swann, 1998; Braunerhjelm & Feldman, 2006). The transition through particular phases in the life cycle is the result of the evolution of its components (Menzel & Fornahl, 2009). Various approaches used to describe the life cycle of clusters can be found in the literature. The differences are evident in the number of developmental phases – from three and four (m.in., Maskell & Kebir, 2005; Pouder & John, 1996; Rosenfeld; 2002; Bergman, 2008; Lorenzen, 2005; Maggioni, 2002), and even to five-six (m.in., Martin & Sunley, 2011; Sonderegger & Täube, 2010; Malakauskaite & Navickas, 2011; Isaksen & Hauge, 2002) – and in their names. In simplification, three main phases can be distinguished in the cluster's life cycle: embryonic (initial) stage, growth (expansion), and maturity combined with decline.

However, the vast majority of publications refer to the cluster viewed in geographical or economic categories. Meanwhile, the development of a cluster-based policy in Europe, implemented at various levels (from supranational to regional) and caused by the incredible popularity of the cluster concept, has contributed to the emergence of new forms of organization related to the cluster. This refers to cluster organizations or – using the nomenclature of Sölvell, Lindqvist, and Ketels – cluster initiatives, which are defined as “organized efforts to increase the growth and competitiveness of clusters within a region, involving cluster firms, government and/or the research community” (Sölvell, Lindqvist, & Ketels, 2003, p. 15). Cluster organizations have separate life cycles, only partially overlapping with the life cycle of clusters. To emphasize the attributes of the organization of cluster initiative (the cluster, due to its definitional and practical indeterminacy and ambiguity, does not have such features), Lis uses the term “cluster organization” (CO). Lis defines CO as a “formally established organization which function at a higher level of aggregation, composed of institutional members that have joined it purposefully and act actively in order to achieve some collective objectives (related to the development of a specific cluster) or individual objectives (aimed at developing their mother organizations)” (Lis, 2018, p. 86). Managing a cluster organization means coordinating the actions undertaken by the collective entities (the institutional members) and individuals engaged in activities undertaken within such an organization.

2.2. Cooperation in clusters structures – results of a systematic literature review

To check how often the thread of cooperation appears in publications devoted to clusters, a systematic analysis of the literature was conducted using two databases: Web of Science Core Collection and Scopus. This analysis also includes categories related to cluster organizations and cluster initiatives (used

interchangeably with clusters and COs), which are the main research objects in this paper (Table 3.1 and 3.2).

Table 3.1. The results of the literature review on cluster structures based on the Web of Science Core Collection

Search criteria	“Cluster”	“Cluster organization”	“Cluster initiative”
Topic or title (all years)	494,912	216	73
Document types: article, book chapter	399,503	156	38
Categories: Business; Management; Economics; Geography	6,634	9	26
„collaboration”	281	1	4
„cooperation”	311	1	3
„trajectory”	55	0	3
„life cycle”	147	0	3

Table 3.2. The results of the literature review on cluster structures based on the Scopus

Search criteria	“Cluster”	“Cluster organization”	“Cluster initiative”
Article title, Abstract, Keywords (all years)	864,353	353	206
Document types: article, book chapter	685,651	268	162
Subject area: Business, Management and Accounting; Economics, Econometrics and Finance; Social Sciences	41,634	67	145
„collaboration”	3,310	18	41
„cooperation”	3,375	26	56
„trajectory”	2,224	5	13
„life cycle”	1,912	15	31

At the beginning, it is worth emphasizing the large disproportion in the number of selected publications devoted to clusters and cluster organizations/initiatives, given the first three adopted categories. The results of a systematic literature review, based on the abovementioned databases, showed that the share of publications containing the keyword “cluster organization” or “cluster initiative” for publications with the keyword “cluster” does not exceed 0.4% (in the case of WoS) and 0.35% (in the case of Scopus). In the second step, four additional categories related to cooperation were considered. In the WoS

database, only a few publications have been found by using the keyword “cluster organization” or “cluster initiatives” in conjunction with “collaboration,” “cooperation,” “trajectory,” “life cycle,” while for the keyword “cluster” the number of identified publications was from 55 (for “trajectory”) to over 300 (for “cooperation”). The Scopus database provided slightly different data – the number of publications devoted to cluster organizations (or cluster initiatives) in combination with four additional categories reaches even several dozen items (least for “trajectory”, most for “cooperation”), while the number for “cluster” reaches over 3,300 (for both “cooperation” and “collaboration”).

An in-depth analysis of the identified items showed that none of the selected publications describes the trajectory of development of inter-organizational cooperation in cluster organizations. Furthermore, in the case of some publications that, according to the used keyword, were to describe cluster organizations or cluster initiatives, they referred to clusters in economic rather than organizational terms.

The same review of the literature was carried out, taking into account the categories related to entities from the comparative sample, i.e. various types of parks. Compared to the cluster concept, the number of publications on park structures is also relatively small, but larger than in the case of cluster organizations and initiatives (Table 3.3 and 3.4). Most publications were identified with the term: “industrial park” and “science park” and the least for “science and technology park.” Considering the same four additional cooperation-related keywords that were used in the analysis of the literature on cluster structures, the number of identified publications regarding all park types included in the analysis decreased significantly. This applies particularly to the database WoS, in which for almost all types of parks, only a few publications were found, except for “science park,” for which 21 items were found in conjunction with the keyword: “collaboration.” The number of publications found in the Scopus database is higher – the largest for keywords: “collaboration” and “cooperation.”

Referring to Polish literature, it is important to emphasize the multithreading of the issues raised in it regarding both the concept of the cluster and the cluster organization. Porter’s concept, popularized in Poland in the early 21st century, became an inspiration for many research teams. However, it should be noted that due to the universality of the interchangeable use of the terms “cluster,” “cluster initiative,” and “cluster organization” in Polish (but also world) literature, it is difficult to clearly divide scientific publications into only one or the other concept.

Table 3.3. The results of the literature review on park structures based on the Web of Science Core Collection

Search criteria	“Technology park”	“Science park”	“Science and technology park”	“Industrial park”
Topic or title (all years)	263	546	129	1700
Document types: article, book chapter	124	351	59	1057
Categories: Business; Management; Economics; Geography	50	180	32	107
„collaboration”	5	21	4	8
„cooperation”	8	9	6	8
„trajectory”	1	3	1	0
„life cycle”	0	4	0	2

Table 3.4. The results of the literature review on park structures based on the Scopus

Search criteria	“Technology park”	“Science park”	“Science and technology park”	“Industrial park”
Article title, Abstract, Keywords (all years)	691	1,057	295	3,370
Document types: article, book chapter	478	761	214	2,255
Subject area: Business, Management and Accounting; Economics, Econometrics and Finance; Social Sciences	320	544	148	809
„collaboration”	92	155	59	93
„cooperation”	84	120	53	123
„trajectory”	7	28	4	29
„life cycle”	12	28	8	144

Publications on cooperation in clusters (or in cluster organizations) can be divided into several thematic groups. The first publications on the concept of the cluster appeared in Poland at the beginning of the 21st century and focused on presenting the specifics of the cluster (Olejniczak, 2003; Gorynia & Jankowska, 2007a; Gancarczyk, 2010). The publications in this period also raised issues related to the impact of clusters on the competitiveness and innovation of the economy (Gancarczyk & Gancarczyk, 2002; Gorynia & Jankowska, 2007b, Poznańska, 2010; Wojnicka, 2002; Kowalski, 2013; Lis & Romanowska, 2015). Along with the development of a cluster policy in

Poland and the launch of support programs for clusters, the scientists began to focus on the functioning of cluster organizations (Olesiński & Predygier, 2002; Włosiński & Szerenos, 2006; Lis & McPhillips, 2016). Publications after 2010 have presented the experience and good practices in the application of the cluster concept in Poland (Wojnicka, 2003; 2005; Knop, 2013; Lis & McPhillips, 2016; Bojar, Bojar, & Bojar, 2016), focusing on selected areas of the functioning of COs. These include the development of cooperation among cluster members, relationships and trust (Jankowska, 2012; Gotz & Jankowska, 2014; Olesiński, 2010; Wasiluk, 2013), cooperation within the supply chain (Frankowska, 2016), and capital conversion (Lis & Lis, 2014a; 2014b). On the basis of the conducted analysis, however, it was found that there are no publications in the Polish literature that would be characterized by a dynamic and holistic approach to cooperation in cluster organizations.

2.3. Commitment in clusters structures

The model that most comprehensively describes the issue of developing cooperation in cluster initiatives was presented by Sölvell, Lindqvist, and Ketels in “The Cluster Initiative Greenbook” (Sölvell, Lindqvist, & Ketels, 2003; Lindqvist, Ketels, & Sölvell, 2013). They described the life cycle of a cluster organization by indicating four stages of its development: antecedence, formation, cluster initiative, and cluster-based institution for collaboration (IFC). Antecedence refers to earlier industry initiatives focused on the implementation of similar goals, affecting the launch of a given cluster organization. What the authors of “the Greenbook” particularly emphasized in the concept of the cluster initiative is the involvement of various entities (both from within and outside the CI), which is a condition for the success of the cluster initiative. In their view, the basis for the functioning of each CI lies in the active participation of three elements of the Triple Helix: enterprises, R&D institutions, and public authorities. Cluster initiatives are an example of private-public cooperation and an expression of a new model of economic policy organization. Therefore, CIs should be treated as a result of joint activities of various government structures, the private sector, universities, trade associations, and other entities, aimed at developing joint solutions beneficial both from the point of view of a given industry and the region. These jointly developed solutions are intended to lead to the improvement of the broadly understood business environment and, thus to higher competitiveness (both at the level of individual enterprises and on the scale of the entire region). This common goal motivates each party to engage actively in cluster initiatives. However, the model proposed by Sölvell, Lindqvist, and Ketels does not reflect the development of cooperative relationships in cluster

organizations – the high level of generality significantly weakens the potential of this concept to solve the defined research problem.

In selected Polish publications, the importance of involvement in cluster organizations is also emphasized. This applies above all to entities that are part of COs, i.e. coordinators and members. It is a prerequisite for the implementation of the goals set by the COs and their associated entities. Involvement, both at the level of the institution (institutional members of the cluster) and at the level of individuals, has been recognized as one of the success factors of the cluster organization (Lis & McPhillips, 2016). The importance of commitment in the development of cluster connections is also confirmed in other scientific publications (Ropuszyńska-Surma & Węglarz, 2012; Bembenek, 2015; Cieślak, 2015; Krawiec & Kutak, 2016; Moszkowicz & Bembenek, 2017), as well as in popular science studies devoted to the concept of a cluster and cluster organization (Koszarek, 2011; Palmén & Baron, 2011; Frankowska, 2012). Commitment in cluster cooperation leads to strengthening the competitive advantage, not only of business entities, but also the region in which a given cluster organization operates (and the cluster it supports). The involvement of entities in COs generates a number of benefits related to the development of a culture of innovation and entrepreneurship, and the concentration of knowledge resources and human capital in a given region, which leads to an increase in its location attractiveness (Nowak, 2013).

Research shows that three levels of involvement can be distinguished: large, medium, and small (or none) (Lis & McPhillips, 2015). Full involvement is most often manifested at the strategic and operational level, while medium or small only at operational level. Engagement at the strategic level refers to active co-creation of the CO's development strategy, while at the operational level, it involves participation in regular meetings and other events (fairs, training and workshops, conferences), participation in working groups, initiation and implementation of joint projects, participation in the incubation of new ventures and activity in the area of internationalization and export expansion. There are also specific benefits associated with the level of commitment, and the greater the commitment, the greater the pool of benefits that can be gained from participating in CO (Lis & McPhillips, 2015).

3. Methodology

The paper includes the outcomes of the quantitative study aimed at analyzing the level of development of cooperative relationships in localized cooperation networks using the example of cluster organizations and technology parks. The study focused on three main areas: motivation, effectiveness and commitment. The questions the study attempted to answer were as follows:

- RQ1) What was the main motivation (expressed in the form of objectives to be achieved) of enterprises when making decisions about joining a cluster organization or locating in a park?*
- RQ2) What was the effectiveness of enterprises in achieving the set objectives?*
- RQ3) How did cluster members and park tenants get involved in activities undertaken as part of being in a CO or park?*
- RQ4) What was the motivation to get involved and how did commitment translate into achieving specific objectives?*

Table 3.5. Levels of the development of cooperation in cluster organizations

Level	Level name	Motivation [M] / Achieved objectives [AO]	Commitment [C]
I	“Integration at the unit level”	M/AO1. Creating a base network of relationships among cluster partners	C1. Systematic participation in regular meetings C2. Participation in events (e.g. fairs, conferences, integration meetings).
II	“Allocation and integration at the process level”	M/AO2. Facilitating access to the increased pool of resources M/AO3. Increasing the quality of products and services and / or reducing the business costs	C3. Participation in subgroups - formal and informal (eg working groups) C4. Participation in training
III	“Impact on the environment”	M/AO4. Impact on the external environment of the organization	C5. Cooperation with other companies, aimed at creating more favorable legal and administrative conditions for running a business C6. Cooperation with other companies, aimed at adjusting the educational profile in the region to the needs of companies
IV	“Creation and integration at the organizational level”	M/AO5. Setting up conditions to create common added value by pooling resources of the cluster entities	C7. Participation in project groups and consortia C8. Participation in teams focused on the development of permanent cooperation, launching joint ventures

The study is based on the concept of the trajectory of the development of cooperative relationships in cluster organizations, developed as a result of previous qualitative research conducted by the author (Lis, 2018; 2019). As part of this concept, four main levels of cluster cooperation were identified, with regard to “the main objectives,” indicating the key type of activity in COs (Table 3.5). At levels, I, III, and IV, one main objective was defined,

while at level II two objectives were identified. In addition, eight basic forms of commitment were distinguished and assigned to specific levels of cluster cooperation (two forms per each level).

The research was conducted in cluster and park structures functioning in Poland. In the case of the first group – cluster organizations – the study was carried out in 2017 in four COs representing both the ICT industry (Mazovia Cluster ICT [MC ICT] and Interizon: Pomeranian Region ICT Cluster) and the metal industry (Metal Cluster of Lubuskie Province [MCLP] and Metal Working Eastern Cluster [MWEC]). The research covered 132 respondents from cluster enterprises: 51 from metal COs (38 from MWEC and 13 from MCLP) and 81 from ICT COs (45 from MC ICT and 36 from Interizon). The study of the second group was carried out in 2019 in three parks: Pomeranian Science and Technology Park Gdynia [PSTPG], Gdańsk Science and Technology Park [GSTP], and Bydgoszcz Industrial and Technological Park [BITP]. The research sample includes in total 137 respondents from park tenants (PSTPG – 81, GSTP – 39, and BITP – 17).

The basic method of data collection was a survey questionnaire. The questions in the questionnaire concerned the three above-mentioned areas: motivation, effectiveness, and commitment and were formulated in such a way as to faithfully reflect the elements of the created concept (Table 3.6), using a 5-point Likert scale. Data analysis included descriptive statistics and the interdependence of variables (using Kendall's tau-b coefficient).

4. Research results

4.1. Cluster organizations

The results obtained for the CO group show that almost all objectives (except M3) defined at distinguished levels of cooperation were recognized by the respondents as significant (they approached or reached 4.0 points), although each to a different degree (Table 3.6). The most important objective that was the main motivation to join the cluster organization was creating a base network of relationships with other cluster members [M1]. Just behind it came the objectives defined at levels IV and III – related to the possibility of undertaking various acts of cooperation with other cluster entities [M5] and exerting greater influence on the environment [M4]. The final places included the objectives defined at level II, regarding access to a wide pool of resources [M2] and increasing the quality of products, and reducing costs [M3]. In each case (M1–M5), the mean exceeded 3 points – the lowest value (3.4) was for M3 and the highest (4) for M1. The two most important objectives related to the

possibility of building a relationship network in the CO [M1] and cooperation with other cluster entities [M5] and were priority areas for the vast majority of respondents (for almost 80% and about 73% of respondents, respectively). In turn, two objectives at the end of the list, related to gaining access to various resources [M2] and increasing quality or reducing costs [M3] were considered significant by half of the respondents.

Table 3.6. Descriptive statistics for cluster organizations (N=132)

Variable	Symbol	N	Mean	Median	Mode	Standard deviation	α-Cronbach
Motivation	M1	131	4.02	4	4	0.83	0.75
	M2	132	3.55	4	4	0.86	
	M3	132	3.44	3	3	1.01	
	M4	132	3.71	4	4	1.02	
	M5	132	3.85	4	4	0.94	
Achieved objectives	AO1	132	2.82	3	1	1.49	0.83
	AO2	132	2.14	2	1	1.23	
	AO3	132	2.02	2	1	1.14	
	AO4	132	2.31	2	1	1.38	
	AO5	131	2.17	2	1	1.30	
Commitment	C1	132	2.87	3	4	1.28	0.93
	C2	132	2.53	2	2	1.26	
	C3	131	2.17	2	1	1.18	
	C4	132	2.46	2	2	1.21	
	C5	132	2.33	2	1	1.14	
	C6	132	2.36	2	2	1.19	
	C7	132	2.26	2	1	1.18	
	C8	132	2.04	2	1	1.14	

Despite the importance that cluster enterprises attached to specific objectives, their expectations in none of the analyzed areas were fully met. The average values of the respondents' answers may testify to the unsatisfactory level of objectives achievement. The average values in all cases did not exceed 3 points, reaching the highest value (2.8 points) at level I in connection with the implementation of the objective related to the possibility of building a network of relationships with other cluster members (previously recognized as the most priority) [AO1]. Low results achieved two objectives relating to areas considered quite important: the possibility of exerting greater influence on an external environment [AO4] and undertaking cooperation with other

cluster entities [AO5] (respectively: 2.3 and 2.2 points). In turn, the lowest average values (2.1 and 2 points) were obtained in connection with achieving the objectives assigned to level II: AO2 and AO3. In each case, the answer most frequently typed by the respondents was definitely negative (meaning no achievement of a given objective). The objective AO1 (building a network of relationships) was not achieved by approx. 45% of the respondents, and by a slightly smaller group (approx. 41%) was considered to be achieved. For the remaining four objectives, the distribution of responses was very similar. Extremely negative answers dominated (over 40% of votes in each case). On the other hand, when counting together, moderate, and definitely positive responses were from approx. 24% [AO4], through approx. 18% and 17% ([AO5] and [AO2]) to approx. 14% [AO3]. The percentage of respondents who could not clearly determine whether a given objective was achieved was also similar (between 17% and 20% of the given answers).

The research results showed that cluster enterprises showed low activity at each level of cooperation – in six out of eight distinguished forms of commitment the mean did not exceed 2.5 points. The highest involvement of the surveyed entities was at level I, especially in the first distinguished area, which was systematic participation in regular meetings organized in CO [C1] (2.9 points). However, taking into account the relatively small effort associated with the above activity, the obtained results cannot be considered evidence of even moderate involvement of the surveyed entities. The more so because the research shows that the percentage of members not involved at all, or weakly involved, in this kind of cluster activity (44%) was higher than those showing above-average activity (39%). However, the smallest commitment of cluster members could be observed at level IV. Over 1/3 of respondents admitted that they did not participate in project groups or consortia launched as part of the CO at all [C7], and more than 44% did not show any activity aimed at developing permanent cooperation within the CO (e.g., cooperation in the value chain or launching a joint business) [C8]. After adding in the above group of respondents who were engaged in each of the above areas only sporadically, it turned out that the vast majority of the surveyed entities (respectively: 62% – project cooperation, 67% – permanent cooperation) did not get involved at all, or hardly at all, in these areas of cluster activity. At each of the cooperation levels discussed above, there was also a group of cluster members not able to assess their involvement in the indicated areas – that is, about 1/5 of all respondents.

The study showed that between the variables commitment and motivation there were relationships, which were identified on the basis of previous qualitative research. This is most evident at levels III and IV (Table 3.7). At level III, both forms of commitment assigned to this level, i.e. engaging in activities related to creating more favorable legal and administrative conditions [C5] and

adjusting the educational profile in the region to the needs of companies [C6], correlated the most with the objective assigned to this level – the possibility of exerting greater influence on public authorities and other institutions [M4]. In turn, both forms of commitment defined at level IV, i.e. participation in project groups and consortia [C7] and teams focused on the development of permanent cooperation, as well as launching joint ventures [C8], correlated to the highest degree with the objective set at this level, i.e. setting up conditions to create common added value by combining resources of cluster entities [M5]. Furthermore, there was also a strong correlation at level I, especially between variables C1 and M1. The analysis does not allow one to determine the direction of dependence, but based on logical arguments it can be assumed that the desire to build a network of relationships with other cluster members [M1] translated into systematic participation in regular meetings organized within the CO [C1]. It is worth noting that the motivation associated with building relationships in CO is more evident at lower than higher levels of cooperation, as evidenced by the strength of correlation with the forms of commitment defined at these levels. Level II commitment (participation in subgroups [C3] and training [C4]) is correlated with all objectives set for the implementation of CO (M1-M5), but the largest relationships occurred in the case of the variable M5.

Table 3.7. The results of the correlation analysis in cluster organizations: [C] - [M] (N=132)

		M1 (I)	M2 (II)	M3 (II)	M4 (III)	M5 (IV)
C1 (I)	Cc	.328**	.285**	.172*	.285**	.216**
	p	0.000	0.000	0.017	0.000	0.003
C2 (I)	Cc	.183*	.243**	.202**	.245**	.208**
	p	0.014	0.001	0.005	0.001	0.005
C3 (II)	Cc	.170*	.176*	.194**	.326**	.368**
	p	0.025	0.019	0.009	0.000	0.000
C4 (II)	Cc	.184*	.241**	.291**	.266**	.279**
	p	0.014	0.001	0.000	0.000	0.000
C5 (III)	Cc	0.144	.219**	.219**	.331**	.296**
	p	0.055	0.003	0.003	0.000	0.000
C6 (III)	Cc	.192*	.178*	0.106	.302**	.291**
	p	0.010	0.016	0.146	0.000	0.000
C7 (IV)	Cc	0.144	.162*	.162*	.223**	.365**
	p	0.057	0.029	0.027	0.002	0.000
C8 (IV)	Cc	0.145	.168*	.199**	.249**	.364**
	p	0.057	0.025	0.007	0.001	0.000

Taking into account the second variable related to the degree of achievement of the objectives [AO], it is clear that at all four levels of cooperation, in relation to each form of commitment defined there, more intensive dependencies occurred with the objective of AO1, referring to building a network of relationships with other members in the cluster (Table 3.8). Although the obtained values are similar, it is worth emphasizing that the lowest occurred at level II and the highest at level IV. Strong correlations were also noted in the case of two variables AO4 and AO5 in the context of the forms of commitment assigned to them. The AO4 variable, associated with exerting greater influence on the external environment of the organization (level III) was most strongly correlated with the form of involvement assigned to the same level – C5 – related to cooperation with other companies, aimed at creating more favorable legal and administrative conditions for running a business (level III). The AO5 variable related to setting up conditions to create common added value by pooling resources of the cluster entities (level IV) was most strongly correlated with one of the forms of involvement at the discussed level: C7, referring to the participation of members in project groups and consortia. However, no correlation (with any distinguished form of commitment) was found in the case of the AO3 variable, corresponding to the objectives related to increasing quality / reducing costs.

Table 3.8. The results of the correlation analysis in cluster organizations: [C] – [AO] (N=132)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
C1 (I)	Cc	.361**	0.064	0.015	.186**	0.053
	p	0.000	0.374	0.839	0.010	0.466
C2 (I)	Cc	.310**	0.092	0.082	.188**	0.009
	p	0.000	0.203	0.261	0.009	0.898
C3 (II)	Cc	.312**	.160*	0.117	.239**	0.135
	p	0.000	0.030	0.116	0.001	0.068
C4 (II)	Cc	.250**	0.136	0.039	0.133	0.071
	p	0.000	0.062	0.596	0.065	0.326
C5 (III)	Cc	.302**	.191**	0.085	.270**	0.138
	p	0.000	0.009	0.246	0.000	0.059
C6 (III)	Cc	.383**	.177*	0.084	.343**	.193**
	p	0.000	0.015	0.250	0.000	0.008
C7 (IV)	Cc	.369**	.252**	0.139	.312**	.347**
	p	0.000	0.001	0.059	0.000	0.000
C8 (IV)	Cc	.362**	.281**	0.126	.279**	.284**
	p	0.000	0.000	0.091	0.000	0.000

The analysis of the correlation between the variables corresponding to the motivation (objectives to be achieved) and the achieved objectives as a result of participation in CO showed the correlations occur at almost all expected points (M1-AO1, M2-AO2, M4-AO4, M5-AO5) (Table 3.9). The exceptions were the variables M3 and AO3 (increases in quality/reduction in costs), between which there was no statistically significant correlation. Considering abovementioned pairs, the strongest relationship between variables occurred at level III (M4-AO4), referring to exerting greater impact on the external environment, and the lowest in the case of level IV (M5-AO5), regarding cooperation based on combining the resources of cluster members to create common added value in the CO. The obtained results show that the AO1 variable is correlated with almost all variables regarding motivation (except M3).

Table 3.9. The results of the correlation analysis in cluster organizations: [M] - [AO] (N=132)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
M1 (I)	Cc	.205**	-0.017	-0.079	0.084	0.034
	p	0.006	0.817	0.298	0.261	0.653
M2 (II)	Cc	.259**	.185*	0.096	0.086	0.060
	p	0.000	0.013	0.203	0.244	0.425
M3 (II)	Cc	-0.031	0.047	0.110	-0.049	-0.004
	p	0.671	0.525	0.137	0.503	0.954
M4 (III)	Cc	.250**	-0.003	-0.006	.295**	0.118
	p	0.001	0.968	0.931	0.000	0.111
M5 (IV)	Cc	.178*	0.118	0.059	.147*	.170*
	p	0.015	0.112	0.433	0.047	0.023

4.2. Technology parks

The study conducted in the group of park tenants has shown that the assessment of the significance of five distinguished objectives is quite similar to that obtained in the group of cluster companies. However, some differences were noted. The biggest difference is that the objective defined at level II, related to obtaining higher quality and reducing costs [M3], the lowest rated in the group of cluster enterprises, received the highest marks in the group of park tenants. Most respondents (around 60%) rated it as important or very important. In turn, all four other objectives were assessed as medium significance (Table 3.10). A very large difference in assessment occurred especially in the case of the objective assigned to level I, related to building the relationship network [M1].

Cluster companies considered it important, while park tenants perceive it as moderately significant (3.2 points).

Table 3.10. Descriptive statistics for technology parks (N=137)

Variable	Symbol	N	Mean	Median	Mode	Standard deviation	α-Cronbach
Motivation	M1	137	3.25	3	3	0.96	0.79
	M2	137	3.38	3	3	0.96	
	M3	137	3.57	4	4	1.03	
	M4	137	2.94	3	3	1.06	
	M5	137	3.24	3	4	1.01	
Achieved objectives	AO1	137	3.36	4	4	1.04	0.77
	AO2	137	3.15	3	4	0.98	
	AO3	137	3.23	3	3	0.88	
	AO4	137	2.64	3	3	1.01	
	AO5	137	3.07	3	3	1.04	
Commitment	C1	137	2.76	2	2	1.11	0.90
	C2	137	3.01	3	2	1.10	
	C3	137	2.62	3	3	1.18	
	C4	137	3.13	3	4	1.03	
	C5	137	2.69	3	3	1.17	
	C6	137	2.54	3	3	1.11	
	C7	137	2.61	3	3	1.19	
	C8	136	2.58	3	3	1.14	

The research has also indicated that park tenants were slightly more effective in achieving all defined objectives compared to cluster companies – in almost all cases the mean exceeded 3 points (except for the AO4 - 2.6 points), while in cluster companies the above value was not achieved in any case. The highest average value was achieved for level I, related to building the relationship network [AO1] (3.4 points). The above objective was achieved in more than half of the surveyed park tenants. Second place was taken by the objective assigned to level II, related to increasing quality/reducing costs (3.2 points), which was achieved by about 36% of respondents.

As in the group of cluster companies, the commitment of park tenants in the activities undertaken in the park should be assessed as rather low (the mean value fluctuated between 2.5-3.1 points). Relatively the largest involvement was observed at levels I and II. This applies especially to participation in training

and participation in additional events (e.g., fairs, conferences, integration meetings), but even in these cases the mean barely exceeded 3 points.

In the case of parks, there is no such large relationship between the forms of commitment and the objectives to be achieved, assigned to individual levels of cooperation. The levels at which the anticipated contact points are most noticeable are I and IV (Table 3.11). Variables regarding participation in regular meetings [C1] and events [C2] organized as part of CO are most correlated with the objective defined at level I – creating a relationship network. In the case of forms of commitment regarding participation in project groups and consortia [C7] and teams focused on the development of permanent cooperation [C8], the highest positive correlation occurred with the variable M5, and thus creating conditions for creating common added value by combining resources of the cluster members. Compared to the results obtained in the CO group, in the parks, the desire to build a relationship network was more marked. The above variable [M1] was correlated with all identified forms of commitment assigned to levels I-IV, especially those assigned to the first two levels (I-II). It is worth noting that there is no correlation between the variable referring to the desire to increase quality or reduce costs due to participation in CO [M3] and any form of involvement [C1-C8].

Table 3.11. The results of the correlation analysis in technology parks: [C] - [M] (N=137)

		M1 (I)	M2 (II)	M3 (II)	M4 (III)	M5 (IV)
C1 (I)	Cc	.261**	.250**	0.110	.201**	.241**
	p	0.000	0.001	0.128	0.005	0.001
C2 (I)	Cc	.243**	0.127	0.113	.245**	.235**
	p	0.001	0.077	0.113	0.001	0.001
C3 (II)	Cc	.297**	.230**	0.113	.196**	.228**
	p	0.000	0.001	0.114	0.006	0.001
C4 (II)	Cc	.258**	.176*	0.136	.229**	.197**
	p	0.000	0.015	0.059	0.001	0.007
C5 (III)	Cc	.273**	.166*	0.034	.215**	.171*
	p	0.000	0.020	0.634	0.002	0.016
C6 (III)	Cc	.228**	.209**	0.080	.290**	.160*
	p	0.002	0.004	0.265	0.000	0.026
C7 (IV)	Cc	.264**	.327**	0.119	.181*	.304**
	p	0.000	0.000	0.094	0.011	0.000
C8 (IV)	Cc	.193**	.165*	0.032	.195**	.221**
	p	0.007	0.021	0.650	0.006	0.002

A study conducted in parks showed that the highest values of the correlation coefficient occurred in the case of variables reflecting the objectives achieved at levels III and IV: AO4 and AO5 (Table 3.12). Both variables were highly correlated with all distinguished forms of involvement, but the strongest relationships were observed between the variables AO and C assigned to the same levels. In the case of level III, these were variables AO4 and C5 and C6, while in the case of level IV - C7. There was also a significant correlation between the variables AO1 and C1 and C2, defined at level I.

Table 3.12. The results of the correlation analysis in technology parks: [C] - [AO] (N=137)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
C1 (I)	Cc	.339**	.243**	.243**	.413**	.370**
	p	0.000	0.001	0.001	0.000	0.000
C2 (I)	Cc	.420**	.192**	0.112	.317**	.364**
	p	0.000	0.007	0.123	0.000	0.000
C3 (II)	Cc	.281**	.290**	.188**	.456**	.258**
	p	0.000	0.000	0.009	0.000	0.000
C4 (II)	Cc	.321**	.280**	.184*	.353**	.369**
	p	0.000	0.000	0.012	0.000	0.000
C5 (III)	Cc	.171*	.174*	0.140	.509**	.222**
	p	0.016	0.015	0.053	0.000	0.002
C6 (III)	Cc	.191**	.197**	0.110	.434**	.188**
	p	0.008	0.006	0.131	0.000	0.009
C7 (IV)	Cc	.245**	.299**	.191**	.367**	.365**
	p	0.001	0.000	0.008	0.000	0.000
C8 (IV)	Cc	0.136	.213**	0.056	.352**	.297**
	p	0.056	0.003	0.438	0.000	0.000

The analysis carried out in the group of parks showed relationships between all analyzed M-AO variables. The highest values were obtained between the corresponding pairs of variables, especially at level IV (M5-AO5) and II (M3-AO3) (Table 3.13).

Table 3.13. The results of the correlation analysis in technology parks: [M] - [AO] (N=137)

		AO1 (I)	AO2 (II)	AO3 (II)	AO4 (III)	AO5 (IV)
M1 (I)	Cc	.465**	.339**	.279**	.316**	.288**
	p	0.000	0.000	0.000	0.000	0.000
M2 (II)	Cc	.377**	.460**	.367**	.215**	.370**
	p	0.000	0.000	0.000	0.003	0.000
M3 (II)	Cc	.286**	.244**	.575**	0.076	.298**
	p	0.000	0.001	0.000	0.289	0.000
M4 (III)	Cc	.274**	.251**	.326**	.459**	.282**
	p	0.000	0.001	0.000	0.000	0.000
M5 (IV)	Cc	.472**	.429**	.293**	.268**	.554**
	p	0.000	0.000	0.000	0.000	0.000

5. Discussion

Referring to the three areas analyzed in the study: motivation, effectiveness and commitment, the conducted research reveals a rather unfavorable picture of the functioning of both cluster and park companies. The research shows that the surveyed companies had various reasons when making decisions about joining a cluster organization or locating in a park. In the case of cluster enterprises, the main motivation was creating a base network of relationships with other cluster members, while park tenants were guided by reasons that are more pragmatic, focusing on achieving higher quality and reducing costs.

The effectiveness of the surveyed entities, assessed on the basis of achieving the objectives assigned to the four distinguished levels of cooperation, however, should be assessed as quite low (based on the subjective opinions of respondents). Although in principle, all the presented objectives were considered by most of the respondents to be significant, they were achieved only by a small group of entities. In the case of cluster enterprises, the greatest effectiveness occurred in relation to building relationships with other cluster members, i.e. the objective recognized in this group as the most priority. Compared to cluster companies, park tenants were slightly more effective. Also, in this group, it was easiest to achieve the objective related to building a network of relationships, as well as the objective of increasing quality and reducing costs, considered the most important in this group.

Turning to the issue of commitment, the attitude of the surveyed enterprises can be assessed as passive. The studied entities in both groups showed low activity at each distinguished level of cooperation, despite the fact that cooperation in both the surveyed cluster organizations and parks was

free from restrictions related to geographical distance. Relatively, the largest involvement in both groups occurred at level I. However, taking into account that in such basic activities, such as regular meetings or additional events, a small number of surveyed enterprises were involved, the obtained results should be interpreted as not satisfactory. At higher levels of cooperation, the involvement of enterprises was even smaller (slightly higher in the case of park tenants). Particularly low commitment was observed at level IV, in relation to participation in project groups and consortia as well as in teams oriented on the development of permanent cooperation.

The research also shows that enterprises from both groups were involved in those areas that they considered important. However, the commitment demonstrated by the surveyed entities at all distinguished levels of cooperation was most correlated with the achievement of the objective relating to building a relationship network. On the basis of the research, one can also logically conclude that the surveyed entities achieved the above-mentioned objective, regardless of their initial motivation.

It is particularly important to note that the literature has not yet examined how cluster organizations can develop cooperation among their component companies. In the literature, it was limited only to the analysis of the consequences of cooperation undertaken within clusters (considered in economic categories). Therefore, it is difficult to compare the obtained results with the previous findings in the analyzed area. However, due to the fact that the specificity of cluster organizations, as well as technology parks, is quite similar to clusters (cooperation in the geographical proximity of enterprises from the same or complementary industries), the results can be anchored in the broadly understood area of clustering. From this perspective, the study supports the thesis that geographical proximity contributes to the development of relationships among cooperating entities (thus, development of social proximity) (Boschma, 2005; Porter, 2008; Hansen, 2015), especially if this cooperation is aimed at achieving common goals.

6. Conclusions

6.1. Contribution and practical implications

The findings add to the state-of-the-art knowledge in the concept of industrial clusters by exposing broader view on cluster cooperation based on geographical proximity, focused on the networking of their constituent companies. Furthermore, the results add both theoretically and empirically to the state-of-the-art knowledge in the still underdeveloped literature on

cluster organizations and technology parks. They show how cooperation within formally established organizations can develop, with particular emphasis on three factors: motivation, efficiency, and commitment. In addition, the conducted quantitative research allowed the pre-testing of some of the assumptions adopted in the created concept of the trajectory of the development of cooperative relationships in cluster organizations, developed on the basis of the author's previous qualitative research (Lis, 2018). It was found that the correlations between the variables (C-M, C-AO, M-AO) confirm the assumptions of the developed concept. However, it turned out that this applies only to cluster organizations, i.e. those entities that were used as research objects in the development of this concept. In the group of parks, the expected relationships between the analyzed variables are not so visible.

Furthermore, the obtained research results indicate that the cooperation among cluster companies and among park tenants is far from the expectations arising from the specificity of the cluster structure. Only a small group of enterprises managed to reach level IV and develop mature forms of cooperation. Therefore, it seems that the potential resulting from the idea of "clustering" is not sufficiently used in the surveyed entities. It should also be emphasized, however, that in both studied groups there was a very large dispersion of the results (this applies to all analyzed variables). This shows that the surveyed cluster enterprises and park tenants achieve different levels of cooperation at different times, which is consistent with the assumptions underlying the aforementioned concept of the trajectory of developing cooperative relationships.

The knowledge of the identified relationships among motivation, effectiveness, and commitment in cluster organizations and technology parks can help these organizations to take conscious actions focused on the development of inter-organizational cooperation, i.e. among cluster enterprises or park tenants. In particular, persons representing cluster coordinators/park management should skillfully shape the levels of cluster cooperation and motivate cluster members/park tenants to be more involved in joint activities to achieve new objectives, and thus climb to higher levels of cluster cooperation.

6.2. Limitations and further research

The study has several limitations related primarily to the relatively small and little diversified research sample. In addition, the study was based on the subjective opinions of respondents. This limits the ability to generalize the results. Nevertheless, the sample size was sufficient to perform the planned analyzes, and the study can be considered as initial work on developing cooperation in localized cooperation networks that are formally established organizations

operating to achieve both collective and individual goals from the perspective of their members/tenants. The study may be of particular interest to countries with an innovation policy similar to Poland, in which both cluster organizations and technology parks are considered an instrument of innovation policy to support the development of companies and regions via networking.

Future research should focus on developing a conceptual model that deepens the relationships among motivation, efficiency, and commitment in cluster organizations. Based on the study results, two propositions can be put forward for a further quantitative investigation (Figure 3.1). In the presented model, the “commitment” [C] variable can play the role of mediator:

P1: The motivation of cluster members (focusing on achieving specific objectives) affects their commitment (form and intensity) in cluster cooperation.

P2: The commitment of cluster members (form and intensity) in cluster cooperation affects the effectiveness in achieving the objectives.

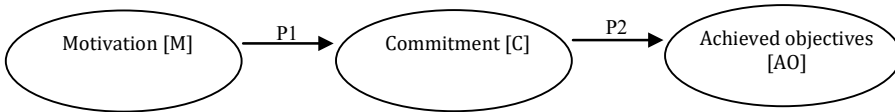


Figure 3.1. The propositions for further quantitative research

The research should be repeated on a representative, large, random sample, using additional comparative groups (other forms, apart from parks, of formal inter-organizational cooperation), which will increase the universality of the tested relationships.

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Biographical note

Anna Maria Lis is the Associate Professor at the Gdansk University of Technology. She is the head of the Department of Industrial Management, Faculty of Management and Economics, GUT. Her scientific and research interests have been focused on problems related to institutional forms of support provided for the development of inter-organizational cooperation (including cluster organizations and business environment institutions). She has participated in numerous research projects implemented at academic centers, as well as in projects requested by public authorities.

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How does stakeholder pressure influence CSR-practices? A construction industry model based on a European sample

Rafał Kowalczyk¹

Abstract

Stakeholder pressure is one of the most vital powers that determines CSR implementation and can provide organizations with the motivation to adopt corporate social responsibility (CSR) strategy, as the stakeholder theory claims. The current investigation is a replication of the author's (2019) study, which examined the same structure of relations based on a Polish sample. The essence of this replication is to find out whether CSR-practice is driven by 'stakeholder pressure' and 'CSR-company culture' varies when controlled by selected European countries or not. Namely, does a 'European model of CSR-practice' embedded in the European culture exist, or does it not exist (yet). Some earlier studies suggest that sociocultural context matters when it comes to CSR-practice. Therefore, this study aims to check how intensively a European cultural context affects organizational cultural context and stakeholder pressure when influencing CSR-practices in the construction industry by employing a sample composed of selected European countries. The author's (2019) model was then replicated based on a convenience sample composed of 282 cases from five European countries. The structural equation modeling method (SEM) was applied to analyze data and verify hypotheses. The findings confirmed that stakeholder pressure has the most substantial influence on CSR-practices. Moreover, although the current study proves that CSR-practice differs depending on the country of its implementation, it does not present all aspects of the potential differences. Further, deeper research is required to understand it better.

Keywords: *CSR-practice, CSR-culture, stakeholder pressure, project management, construction industry*

¹ Rafał Kowalczyk, Pomorskie Centrum Technologiczno Badawcze Sp. z o.o PCTB, ul. Morska 521, 81-002 Gdynia, Poland, e-mail: rafal.kowalczyk@pctb.pl

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1. Introduction

CSR-practice reflects the actual company's CSR actions and behaviors (Eisingerich & Rubera, 2010; He & Li, 2011). Kowalczyk (2019) and Kowalczyk and Kucharska (2019) used Polish and German samples to prove that stakeholder pressure has the most substantial influence on CSR-practices. They also hypothesized, by comparing their findings to Asian models (Yu & Choi, 2016) in which company culture was identified as a focal predictor of CSR-practice, that stakeholder pressure might be the vital power influencing CSR-practice, not only in Poland or Germany but also generally in Europe. Hence, the study aims to verify this assumption by replicating Kowalczyk's (2019) study on the European sample in an empirical manner. The rationale for this replication is to verify the obtained by Kowalczyk (2019) results of his study. The replication as a scientific activity is an integral part of scientific knowledge production. It generally increases confidence that the obtained earlier results exist. It is a valuable act, and more unexpected findings were presented.

Moreover, a replication enables to observe how findings may change between samples, and if it happens, replication provokes the question: why? So, a more in-depth understanding of the phenomenon is possible. So, this study aims to verify Kowalczyk's (2019) assumptions and to deliver the knowledge which allows to understand more in-depth the phenomenon of stakeholder pressure influence on CSR-practice in construction industry across Europe. Hence, the paper first presents the conceptual framework of the study. It then goes on to describe the methodology. The third part presents the findings and includes a discussion. Finally, the conclusion gives a summary of the work in light of its limitations.

2. Literature background

The environmental impact of the construction industry is modified by different agents (Alotabi et al., 2019). According to the stakeholder theory, the major factor that affects CSR implementation is stakeholder pressure (Yu & Choi, 2016). This pressure often stands behind a company's motivation to implement a corporate social responsibility (CSR) strategy (Clarkson, 1995). Leon (2017), McPherson (2019), and Phuong and Harima (2019) stressed the importance of cultural values for business activities. In their earlier works, Kucharska and Kowalczyk (2018) confirmed the substantial effect of national culture dimensions on CSR-practices. In 2007, Whelan noticed that CSR does not function without a certain sociocultural context and thus emphasized how important cultural setting is when studying CSR. Moreover, Bedford and Kucharska (2020) noted that company culture is always embedded in the

national culture. Therefore, multinational companies very often observe that even having developed a corporate culture, the cultures of national subsidiaries in some way differ one from another. Hence, on the one hand, national cultures determine companies' behaviors, while, on the other hand, European culture is a culture of nations that reflects shared values, beliefs, and behaviors. So, it is interesting to find out: how does the pressure of stakeholders influence the CSR culture of organizations and their practices in Poland and other European countries? Namely, does a common 'European model of CSR-practice' embedded in the European culture exist, or does it not exist (yet).

Drawing on findings by other researchers, this study focused on CSR-practices in selected European countries to determine how they are affected by stakeholder pressure and culture. This project provided an exciting opportunity to compare organizations in Poland (an example of a young EU country), and their level of social maturity when it comes to sustainability, with more advanced western countries. The construction industry in Europe has been undergoing a period of rapid development since 2014, and Poland has benefited greatly from this fact (KOF, 2017). The construction industry has been a focus of Kucharska and Kowalczyk's studies for quite some time now. They have been investigating the factors that affect project performance using the example of the Polish construction sector. In their studies, they proved the strong effect of company culture (a predictor) as well as trust and creativity (mediators) on the said project performance (2016a, 2016b). However, a topic that has not yet been properly examined is to what extent CSR-practice, stakeholder pressure, and culture affect the project performance of European companies. Kowalczyk (2019) and Kowalczyk and Kucharska (2019) used Polish and German samples to prove that stakeholder pressure has the most substantial influence on CSR-practices. Hence, the authors decided to adopt Kowalczyk's (2019) model of stakeholder pressure, culture, and CSR-practices to examine and understand the relationships within the construction projects in Europe.

2.1. CSR-practice and stakeholder pressure

By translating the theory of Corporate Social Responsibility into practice, an organization can "do well by doing good" (Falck & Heblich, 2007). No company can afford to ignore the principles of CSR. According to Falck and Heblich (2007), CSR is a voluntary commitment of a company to exceed the explicit and implicit obligations the state and society may have placed on it. Therefore, CSR promotes socially responsible behaviors in order to facilitate a requisite order concerning both legal and communal norms. What helps a company implement CSR strategy are different groups of interest called stakeholders who influence or are influenced by this organization. The

stakeholder group may include state institutions, various organizations, local communities, or individual persons (Freeman, 1984). The conditions that have to occur for CSR-practices to take place, as well as their consequences, are explained by Stakeholder theory (Clarkson, 1995). According to Story and Neves (2015), an organization that does not undertake CSR-practices and ignores stakeholders puts at risk its well-being. The construction industry, with its complex dependencies, is a good example of a two-way relationship between an organization and its many stakeholders. CSR-practices are oriented towards various stakeholder groups (Melo & Garrido-Morgado, 2012; Michelin, 2011) whose pressure on an organization can cause a permanent effect (Clarkson, 1995). In their works, You and Choi (2016) maintain that stakeholder pressure has a constructive impact on companies when it comes to the adoption of CSR-practices and creating a CSR-oriented culture. Kowalczyk (2019) proved that stakeholder pressure positively influences the CSR-culture and CSR-practice of organizations in Poland. The analysis of the body of literature presented up to this point resulted in formulating the following hypotheses:

H1: CSR-stakeholder pressure influences CSR-culture of an organization in a positive way.

H2: CSR-stakeholder pressure influences CSR-practices in a positive way.

2.2. CSR-oriented culture

The “social glue” that holds a company together is its organizational culture. It bonds people together and gives meaning to their corporate life; it enables them to share knowledge and improve their performance (Kucharska, 2017). CSR-oriented culture provides all employees with shared foundations, beliefs, and values that are identified with CSR (Linnenluecke & Griffiths, 2010). An employee’s values, norms, as well as beliefs, impact the way they view CSR (Quazi, 2003; Hur & Kim, 2017; Kucharska & Kowalczyk, 2018), e.g., switching the focus from the company’s needs to those of the stakeholders (Galbreath, 2010). A win-win strategy and contributing to the common good are the outcomes of an organizational culture that affects all operational practices and company performance that include CSR-practices and operations (Kalyar et al., 2013; Takahashi & Nakamura, 2005; You & Choi, 2016). Kowalczyk (2019) proved that CSR-culture positively influences the CSR-practice of organizations in Poland. Therefore, it is possible to hypothesize that also in the broader, European context:

H3: CSR-culture influences CSR-practices in a positive way.

2.3. Project performance

The way to manage the construction industry is primarily through projects. If a company operates efficiently, its projects bring about environmental change. There are many approaches to project management. The most popular methodologies have been designed by the Project Management Institute (PMI) and the Organization of Government Commerce (OGC). These include PRINCE2 and Project Management Body of Knowledge (PMBok). Their goal is to deliver projects on time, in the proper scope, and on budget. The probability of effective project implementation, as a result of applying a particular project management methodology, is even greater as all of the above-listed approaches obligate their participants to preserve a continued business justification (PRINCE2, 2009). The success of a project is measured by its final performance, and in the case of the construction industry, it is a complete and ready-to-use physical structure such as a road, a building, or a bridge. The theme of professional and social competences that support the successful delivery of construction projects came up in the works of Omar and Fayek (2016). Kowalczyk (2019) proved that CSR-practice positively influences construction project performance in Poland. Drawing on these discoveries, the hypothesis has been developed as follows:

H4: CSR-practices influence project performance in a positive way.

Control variable

Based on Kowalczyk (2019) and Kowalczyk and Kucharska's (2019) findings, to achieve the aim of this work, the author decided to include "country" as a control variable of the study. The reason behind this was to explore not only the general difference between the results obtained by Kowalczyk (2019) and the current study, or the stakeholder pressure as the main influencing power of CSR-practice in Europe, but also to check directly how the "country" factor matters for CSR-practice. Hence, the hypothesis has been formulated as follows:

H5: The "country" factor influences CSR-practices.

Expected mediation

It is also necessary to verify the mediation of CSR-culture in the relationship between stakeholder pressure and CSR-practice observed by Kowalczyk (2019). Therefore, the hypothesis has been developed as follows:
CSR-pressure->CSR-culture->CSR-practice

Figure 3.2 summarizes all the theoretical assumptions listed above.

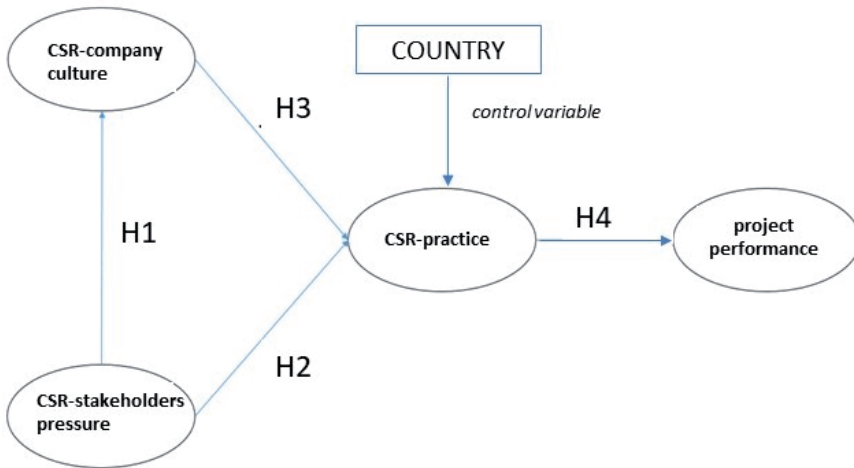


Figure 3.2. Conceptual framework – visualization

Source: Kowalczyk (2019).

3. Research approach and methods

To achieve the aim of this study, data were obtained electronically using a self-report questionnaire, mainly via emails addressed to HR departments in construction companies. Therefore, the method of sampling was convenience. Respondents answered questions adapted from validated measurement scales for all constructs included in the theoretical model. Appendix 1 lists the sources of the scales and statements, as well as reliabilities for each of the used constructs. Participants responded to statements based on a 7-point Likert scale using self-report questionnaires. To determine whether the respondents had the necessary knowledge to complete the questionnaire correctly, they had to have been working in the construction industry for more than one year and be familiar with the company's results at a general level during this period. Before undertaking the main survey, a pilot study was run to improve the flow and understanding of the statements. Data were collected between April and June 2019. In total, 282 valid cases were gathered across Europe, including France (20%), Great Britain (21%), the Netherlands (19%), Germany (20%), and Poland (20%). The sample was controlled to gather an equal number of cases from each country. Most respondents were men (96%) aged 26–35 (43%) or 36–45 (32%) who worked as team members (78%) in large-sized (39%) or medium-sized (28%) companies. The convenience method of sampling

was employed in this research. HR departments of construction companies were asked for help, and respondents answered voluntarily. The Kaiser–Meyer–Olkin (1974) test of the sample’s adequacy to the measured factors was applied, and the obtained result was 0.923, which is considered excellent. The total variance explained by the sample was 74%, which was also positive (Hair et al., 2010; Byrne, 2016). Harman’s single-factor test Podsakoff and Organ (1986) was applied. The obtained result was 48%; at less than 50%, the level of bias was considered acceptable. Structural equation modeling was used to analyze the data. Measurement and structural Confirmatory Factor Analysis (CFA) models were developed for the theoretical model shown in Figure 3.2, which were then estimated, and their goodness of fit was assessed. The maximum likelihood method (ML) was used to estimate the model. According to the CFA, the model in Figure 3.3 fits the data well.

The level of model reliability at 2.77 is a good result, with the reference point of ≤ 5 (Wheaton, 1977). The models fit the data at 0.80, based on the test of approximation average error RMSEA, meets the reference values ≤ 0.08 , after Stieger and Lind (1980). The results for the goodness of fit approached 1 (Bollen, 1986, 1989) and TLI = 0.924, CFI = 0.941. They confirm the assumed quality. The value of AVE (Average of Variance Extracted) is 0.5, which is acceptable (Hair et al., 2010). All the details of the tests are presented in Appendix 1. A goodness of fit value for the model came close to 1 (Bollen, 1986, 1989), which corroborates the quality mentioned earlier.

4. Results

Table 3.14 presents the summary of descriptive statistics and constructs the correlation matrix with the square root of the AVE on the diagonal to verify if used to the empirical model variables supercharged one another or not. It has been noted that stakeholder pressure supercharged CSR-practice a little bit. The correlation between these variables is quite high at 0.834, but squared AVE of CSRsp is only 0.01 lower than the noted correlation. Hence, the procedure of data analysis continued.

Table 3.14. Descriptive statistics and constructs correlation matrix with the square root of the AVE on the diagonal

Variable	Mean	SD	AVE	CR	Cronbach alpha	CSRsp	CSRc	CSRp	PP
CSRsp	5.19	1.07	0.69	0.86	0.867	0.833			
CSRc	5.18	1.13	0.67	0.86	0.855	0.790	0.816		
CSRp	5.34	1.04	0.60	0.82	0.848	0.834	0.810	0.774	
PP	5.33	1.09	0.59	0.81	0.810	0.680	0.645	0.766	0.768
country	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	.083	.065	.226	.18

Note: Abbreviations: CSRsp – CSR-stakeholder pressure; CSRc – CSR-company culture; CSRp – CSR-practice, PP – project performance; n/a – not applicable.

All the formulated hypotheses are confirmed (Table 3.15). The obtained results prove that stakeholder pressure has a strong significant impact on CSR-practice, and finally also on project performance in the construction industry in Europe. The mediated effect of CSR-oriented company culture on stakeholder pressure and CSR-practice also is confirmed. Moreover, the imputed control variable – the “country” influence on CSR-practice also obtained a significant result (Figure 3.3). It is worth highlighting that the obtained R²=.63 result for the project performance variable means that the presented model explains the phenomena in 63%, which is good.

Table 3.15. Verification of hypotheses

Hypothesis	β	t-value	p-value	Hypotheses’ verification
H1 CSR-stakeholder pressure influences CSR-culture in the company in a positive way.	0.79	10.88	***	supported
H2 CSR-stakeholder pressure influences CSR-practices in a positive way.	0.56	5.72	***	supported
H3 CSR-culture influences CSR-practices in a positive way.	0.36	3.80	***	supported
H4 CSR-practices influence project performance in a positive way.	0.79	10.17	***	supported
H5 Country factor influences CSR-practices.	.16	3.73	***	supported
Mediation analysis	Total effect	Direct effect	Indirect effect	Mediation observed
CSR-pressure->CSR-culture->CSR-practice	.84***	.55***	.28***	complementary mediation

Note: n = 282 cases, Chi-square = 197.218 CMIN/df = 2.77, df = 71, TLI = .924, CFI = .941, RMSEA = .080, CI (.066–.093) estimation standardized, ML. ***p < 0.001

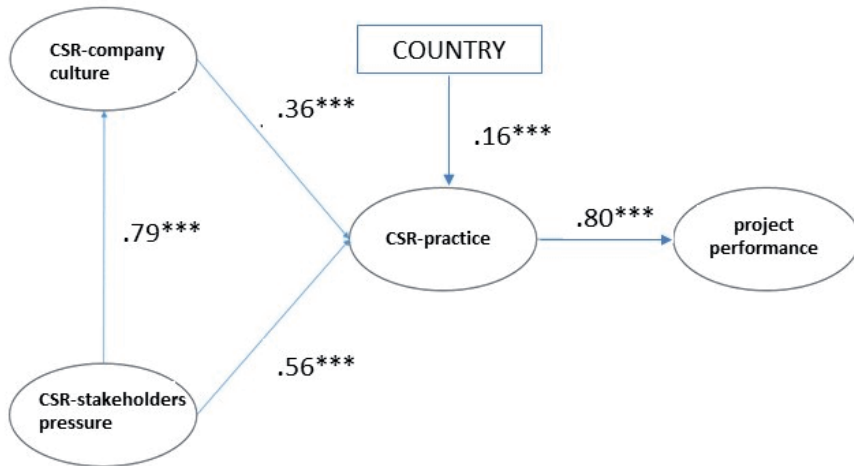


Figure 3.3. Results

Note: $n = 282$ cases, Chi-square = 197.218 $CMIN/df = 2.77$, $df = 71$, $TLI = .924$, $CFI = .941$, $RMSEA = .080$, $CI (.066-.093)$ estimation standardized, ML, $***p < 0.001$.

5. Discussion, limitation and further research

Generally, the results of this study confirm all the findings gathered by Kowalczyk (2019). Stakeholder pressure is a significant power of influence on CSR-practices, not only in Poland and Germany but also in other European countries, especially when facilitated by the company’s culture. As was pointed out in the introduction to this paper, company culture plays an important role in the construction industry managed by projects, and mediates the relationship that takes place between environmental pressure and CSR-practices. The observed mediated effect of CSR-oriented company culture on stakeholder pressure and CSR-practice is even stronger than noted by Kowalczyk (2019). It has been confirmed that stakeholders put strong pressure on construction businesses across Europe to make them socially and environmentally responsible. CSR awareness is spread and increased by education, and mass media is gaining increased significance for “the better good” of all European societies. Sroka and Szanto (2018) pointed out that companies in central European countries today want to be perceived as ethical. This paper demonstrates that external stakeholder’s power pressure helps profit-oriented organizations efficiently change their focus. The most noticeable result to emerge from the data shows a strong correlation between CSR-practice and project performance. However, it matches the level obtained by Kowalczyk (2019). We cannot argue that the construction industry has an impact on the

environment. As a result, it is not hard to imagine that the local community's disapproval and objections can entirely ruin a project's timeline, together with its budget, and the scope of planned works. Therefore, it is understandable that CSR-practices have an impact on the performance of a construction project in a significant way. Based on the obtained results, it may be concluded that it is a consistent phenomenon across Europe. The undisputed value of the achieved measures is that the $\beta=0.83$ (Poland), as well as $\beta=0.80$ (Europe), proves to us the power of CSR-practices. The main limitation of the study was choosing a non-random sampling method; however, it would be very difficult to obtain a European sample in any other way.

It is worth highlighting that the model presented in this study links CSR-practices and project performance in an uncomplicated way. The earlier conclusions of Kucharska and Kowalczyk (2018, 2016a, b) could lead to the conclusion that the relationships between CSR-practices and construction project performance are more intricate, chiefly because the project performance variable R^2 equals 0.63. This value indicates that 37% of other factors that could be important for project performance have not been properly taken into consideration by this study. This knowledge gap needs to be bridged and justifies further research. Another motivation for the continuation of the presented studies is included in the control variable "country" $\beta=0.16$ (***), which confirms that the country factor matters for CSR-practice across Europe. However, the current study does not present all aspects of the potential differences. Further studies are required to understand it more in-depth.

6. Conclusion

The study sought to investigate critically how CSR-stakeholder pressure, CSR-company culture, and CSR-practices affect one another in the European construction industry. The findings of the research indicate that the most powerful factor that has an impact on CSR-practice is stakeholder pressure. Another conclusion is that there is a strong connection between CSR-practices and project performance. It proves that the construction industry, due to its environmentally invasive nature, simply must not withhold the implementation of CSR strategies, for the sake of its business' successful operation. The construction industry is a good example of a close-knit dependency between the success of a society and a business. To understand it better further in-depth studies are needed.

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Appendix

Appendix 1. Scales and their reliabilities

Construct	Scale	Reliability assessment
CSR-oriented culture Source: You and Choi (2016)	Employees have a strong degree of awareness of CSR-culture Our leader believes and values the adoption of CSR-culture Our organization is developing a strategy on CSR activities Our organization has a CSR-training program for employees	AVE = 0.67 CR = 0.85 Cronbach alpha = 0.855
CSR-pressure of stakeholders Source: You and Choi (2016)	Employees put pressure on us to maintain CSR-practices Customers put pressure on us to maintain CSR-practices Company owners put pressure on us to maintain CSR-practices Partners put pressure on us to maintain CSR-practices The government puts pressure on us to maintain CSR-practices	AVE = 0.69 CR = 0.86 Cronbach alpha = 0.867
CSR-practice Adapted from Eisingerich and Rubera (2010) He and Li (2011)	The organization is socially responsible My company cares about the local community It is important to act ethically The company cares about employees	AVE = 0.60 CR = 0.82 Cronbach alpha = 0.848
Project performance Source: Gemino et al. (2015), Babbie (2013)	I was informed that the Sponsor of the project was satisfied with the project results I was informed that the Sponsor of the project was satisfied with the project benefits I received feedback that the Sponsor of the project assessed the project positively	AVE = 0,59 CR = 0,81 Cronbach alpha = 0.810

Biographical note

Rafał Kowalczyk is the President of the Board of the Pomeranian Technology and Research Center. He is an author and co-author of several scientific publications in the field of CSR, project, and organizational management. Recently, his most important publications are *How to achieve sustainability? Employee's point of view on a company's culture and CSR practice*. *Corporate Social Responsibility and Environmental Management* (2019), *Corporate social responsibility practices incomes and outcomes: Stakeholders' pressure, culture, employee commitment, corporate reputation, and brand performance*. In addition, a Polish–German cross-country study. He has managed many construction projects and implementation projects, especially in the area of

the analysis and design of organizational structures, management system, innovative technologies, and quality systems in companies in the construction and energy industries.

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Impact of the food industry in Poland on the environment and society: Results of an empirical research study and a model of the process of change towards sustainable development

Anna Kurzak-Mabrouk¹

Abstract

*The aim of the conducted research study is to present model solutions for food industry companies that will contribute to the implementation of sustainable development in their business operations. The study involved analyzing data concerning production, consumption, and consumer purchasing decisions, and also carrying out individual interviews with presidents/directors of food industry production companies on the subject of balancing particular areas of business activity, which resulted in creating an original model for conducting sustainable business activity in all areas. As a result of the conducted research study, it was proved that production companies in the food industry implement sustainable development to an unsatisfactory extent in various areas of their business activity. The information thus gathered prompted the creation of an original model that can be applied in practice in enterprises in order to implement sustainability in their strategies. So far, companies have not introduced comprehensive actions in the field of sustainable development into their strategies. Since the measures through which sustainability is implemented are holistic, it is necessary to employ a sustainability specialist in each company who is responsible for coordinating these activities. The implementation of sustainable development into the business activities of food industry enterprises is crucial when determining the strategy, as production activities have a negative impact on society and the natural environment. So far, a model has not been constructed for food industry enterprises that aims to implement the principles of the concept of sustainable development for particular stages of their activity. **Keywords:** sustainable development, sustainable business, food industry, sustainable enterprise, personnel*

¹ Anna Kurzak-Mabrouk, Ph.D., Assistant Professor, Faculty of Law and Economics, University of Humanities and Natural Sciences; J. Długosza in Częstochowa, 4/8 Waszyngtona, 42-200 Częstochowa, Poland, e-mail: anna.magister@gmail.com (ORCID ID: 0000-0003-1905-7325).

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1. Introduction

Production companies have been growing since the mid-20th century. The expansion of the industry has contributed to the emergence of an increased number of negative developments in the natural environment. In the present geological era, which is called the anthropocene, a climate change has taken place, the oceans have become acidified and the biomes² have begun to disappear so quickly that it is possible to measure these processes during the lifetime of one generation. The accelerated pace and direction of the changes that are occurring make us think that the Earth may become less and less friendly to people from one year to the next (Richardson et al., 2011). Human behavior is characterized by many negative factors, and it is important to assess which of them constitute the greatest threat to what the planet could be capable of withstanding (Rockström et al., 2009). Observing this particular course of development, it can be concluded that the future of many organisms is becoming increasingly uncertain. The Living Planet Index measuring biological diversity, based on 14152 monitored populations of 3706 vertebrate species, gives a cause for concern as it shows a downward trend. Between 1970 and 2012, there was a decrease of an average of 58% in the populations of monitored species, with a more noticeable decline in freshwater species. However, with the Ecological Footprint Index, which measures the ecological footprint, we can see what the relationship between the Earth's biocapacity and human activity is. This index shows what is the human demand for access to the renewable resources available as well as sustainable services (Global Footprint 2016). Expansive economy makes it impossible to recover planet Earth's regenerative capacity to the pre-industrial state. Numerous ecological and social threats that have begun to occur in the world have led to global actions to prevent them, which has consequently resulted in the development of the concept of sustainable development.

2. Literature background

Over the years, during numerous actions in the global arena, many definitions of sustainability have been developed. Almost two years of the work of the Brundtland Commission (Our Common Future, 1987) resulted in one of the first definitions, which says that sustainable development provides an opportunity to meet the current expectations of societies without fear that the needs of future generations will not be met (Brzustewicz, 2013). Continuity of work on the concept of sustainability was ensured by the United Nations Conferences devoted to the problems of the environment, man and sustainable

² Biom – a vast area with a specific climate, characteristic vegetation and a particular animal world.

development, which took place in 1972 in Stockholm, during the Rio de Janeiro Earth Summit held in 1992 (Kowalczyk, 2010), where Agenda 21 was created (Agenda 21, 1997), in 2002 in Johannesburg and again in Rio de Janeiro in 2012. Other conferences of the parties to the agreement on the climate convention are held more frequently and, due to the solutions adopted in Kyoto, where the Kyoto Protocol to the United Nations Framework Convention on Climate Change was adopted, were the most widely publicized. (Kyoto Protocol, 1997), in the Hague in 2000 (Kurzak, 2014a), and 2015 in Paris. One of those events also took place in Poland, i.e. in Poznan in 2013. According to the principle of intragenerational and intergenerational equity, it is through sustainable development that it is sought to provide the present, as well as future generations, with ecological, socio-cultural and economic standards at a high level so that the natural limits of the planet's capacity are not exceeded (Rogall, 2010). Numerous definitions of sustainability contain coherent elements, such as social and economic development, which is supposed to consolidate the activities of societies aiming at making the possibilities of future generations to live in a clean environment as equal to ours as possible (Korol, 2007). Solving the greatest global problems of modern times is necessary to change the world (Kotler, Kartajaya, & Setiawan, 2010). In order to achieve sustainable development, it is necessary to ensure the coherence of the triad of its goals: economic growth, environmental protection, and social inclusion. These elements are inseparable and equally important for individuals and societies as a whole to achieve prosperity in a clean environment. Sustainability is a concept that is supposed to balance its three basic objectives to an equal extent (Adamczyk, 2001). Sustainable development is characterized by three dimensions, i.e. the environmental, social, and economic ones. The inter-dimensional convergence is of a complex nature as sustainable development must also be implemented with regard to its extent, i.e. its spatial impact, where 5 stages of its implementation can be distinguished: 1 – the unit level comprising an economic unit, 2 – the local level covering a unit of territorial division, 3 – the regional level covering a region, 4 – the national level covering the country, and finally 5 – the global level covering the whole world.

The current globally recognized document containing the 17 sustainable development objectives is the 2030 Agenda for Sustainable Development (2015 Agenda for Sustainable Development). This document expects activities at lower levels of implementation of sustainability to be accounted for. The principle of sustainable development is included in the Constitution in Article 5 (Constitution, 1997), which indicates its importance at the national level. The implementation of sustainable development at the regional level is described by numerous authors in their works, indicating the region as a relatively

homogenous area, which is distinguished from others by its natural features and similarly at the local level (Elkin, McLaren, & Hillman, 1991; Peński, 1999; Martos, Pacheco-Torres, Ordóñez, & Jadraque-Gago, 2016; Andrzejewska, Łuczak, & Szumilas, 2010; Staniak 2009; Stanny & Czarnecki, 2011). The last level covering the implementation of sustainability indicates the unit level comprising enterprises as well as households. The literature indicates that sustainable development is also considered in terms of the sectors of the economy, which include the energy sector (Chu & Majumdar, 2012; Edomah, 2016; Lund, 2007; Micoła & Micoła, 2013), tourism (Iliopoulou-Georgudaki, Kalogeras, Konstantinopoulos, & Theodoropoulos, 2015; Maxim, 2016; Panfiluk, 2011), industry (Azapagic, 2004; Kurzak-Mabrouk, 2017; Lawless & Medvedev, 2015), transport (Chmielinski, 2015; Greene & Wegener, 1997; Petranović, Vujanović, & Duić 2015; Richardson, 2005), agriculture (Czyżewski, 2012; Tilman, Balzer, Hill, & Befort 2011; Veisi, Liaghati, & Alipour 2016), as well as teaching and education (Beynaghi, Moztaizadeh, Mozafari, Maknoon, & Leal Filho, 2016; Kurzak, 2014b; Velazquez, Munguia, Platt, & Taddei, 2006; Wawak, 2015). The above proves that sustainability has penetrated numerous sectors of the economy at various levels. Guidelines valid at a higher level (e.g., national) must be respected at a lower level (e.g., in a company that carries out business activities according to the principles of sustainable development). It should be stressed at this point that sustainable development should be implemented starting at the bottom and working its way upwards. Appropriate measures need to be adopted at the lowest level so that expected objectives could be achieved at the highest level.

Sustainable development is a concept that directly resulted from the global economic crisis; thus, it is connected with the need to adapt to the ongoing changes in an uncertain environment – changes that are permanent and difficult to predict in an environment conditioned by chaos. These conditions shape economic, social, and political changes that are difficult to plan (Grudzewski et al., 2010). Sustainable development was created as a consequence of a continuously deteriorating condition of the natural environment and threats emerging from the ways in which societies operate (Pabian, 2013). The result of adjusting to sustainability is restoring the balance, or, at least, not disturbing it further. In order to have as many customers as possible, large food companies must respect their customers' expectations (Porter & Kramer, 2011). There are no models presented in the publications to date that could facilitate the implementation of sustainable development principles in business activity.

3. Research approach and methods

The food sector includes producers of foodstuffs³ for people and animals, producers of beverages, including alcoholic beverages⁴, and producers of tobacco products⁵. The food sector does not include producers of agricultural products, livestock farmers and those engaged in fishery (capture of wild fish and fish farming alike)⁶ ⁷, and food distributors and entities preparing meals ready for direct consumption⁸. Food products are classified according to the criterion of shelf life, with a distinction being made between perishable and non-perishable products. Consumers, for example, pay special attention to the best-before date (expiry date). In the European Union, the issue of durability of food products is regulated by Directive 200/13/EC of the European Parliament and of the Council (Directive, 2000), as amended, and in Poland, the issue of the best-before date of food products is regulated by the Act on Food Safety. The data presented in the table below explain why the author has chosen to use large food industry companies for her research study. This part of the study was based on the analysis of data on production, consumption, and consumer purchasing decisions. This element acknowledges the size of the food sector in Poland and accounts for the fact that the production of food products has a negative impact on the environment and society.

In Poland, there are 206926 processing industry businesses registered and the number of businesses operating within the food sector, including the production of beverages and tobacco products, totals 16873, which is over 11%, placing the food sector in 5th place. The sold production of the entire processing industry amounts to 1220552.6 million PLN, including the food industry producing beverages and tobacco products 243089.2, which constitutes 20% (GUS Statistics Poland). This indicates that the sold production of food products constitutes a significant part of the sold production of the processing industry, which confirms the relevance of this study. These data are included in Table 3.16.

In 2017, the largest revenue from the total activity of industrial enterprises was achieved by the food industry in the amount of PLN 263294.7 million constituting almost 20% of the total revenue of the processing industry, which amounted to PLN 1277566.8 million, confirming its importance for the Polish economy.

3 Section C of the Polish Classification of Activities, Division 10.

4 Section C of the Polish Classification of Activities, Division 11.

5 Section C of the Polish Classification of Activities, Division 12.

6 Section A of the PKD Polish Classification of Activities.

7 Section G of the PKD Polish Classification of Activities, Division 46 – wholesale trade.

8 Section I of the PKD, division 56 – food and beverage service activities.

Table 3.16. Characteristics of the food industry in relation to the processing industry

Business entities	2014/2017			
	Processing industry	Manufacture of food products	Production of beverages	Manufacture of tobacco products
Number of economic entities	187520 206926	14142 16239	483 592	33 42
Industry production sold (current prices – PLN million)	995888.2 1220552.6	187777.8 217749.7	19860.5 19009.7	4331.9 6329.8
Revenues from the total activity of industrial enterprises (total – PLN million)	1114687.9 1277566.8	190872.8 218098.5	31606.7 31367.6	11715.4 13828.6

Source: Author's own compilation based on <http://stat.gov.pl>.

Table 3.17. Production of foodstuffs sold in 2017, Section C Divisions 10– 12

Description	millions of zlotys
Food production, including:	146347.6
processing and preservation of meat and production of meat products	45721.8
processing and preserving fish, crustaceans and molluscs	7502.9
processing and preservation of fruit and vegetables	12299.5
production of oils and fats of vegetable and animal origin	4225.3
manufacture of dairy products	26929.8
manufacture of grain mill products, starches and starch products	3963.4
manufacture of bakery and farinaceous products	9956.2
manufacture of other food products	23274.3
production of prepared feeds and pet foods	12474.4
production of wine, beverages, soft drinks, and water	17743.8
manufacture of tobacco products	4307.3

Source: Author's own compilation based on <http://stat.gov.pl>.

Table 3.17 shows that the highest result of the production of sold food products was achieved by processing and preservation of meat and production of meat products, which amounted to PLN 45721.8 million. This is followed by production of dairy products PLN 26929.8 million and production of other food products including mainly confectionery products amounting to PLN 23274.3 million. Table 3.18 shows the average monthly expenditure per person and how much one person spent in 2017.

Table 3.18. Monthly spending/consumption in the sector of households in 2017

Description	Average monthly expenditure per person in PLN	Consumption in the household sector in million PLN
Total	1 078.74	1 018 578
Consumer goods and services	1 031.62	-
Food and non-alcoholic beverages	263.34	175621
Alcoholic beverages and tobacco products	27.24	70397
Clothing and footwear	57.78	46935
Home use and energy carriers	216.73	220393
Home furnishings and housekeeping	52.76	50003
Health	53.95	48722
Transport	98.99	123494
Communication	54.17	25372
Recreation and culture	70.13	77882
Education	11.98	10570
Restaurants and hotels	45.09	33369
Other expenditure on goods and services	62.51	135820
Expenditure on food and non-alcoholic beverages against total expenditure (%)	24.4	-
Expenditure of home use and energy carriers against total expenditure (in %)	20.1	-

Source: Author's own compilation based on <http://stat.gov.pl>.

Table 3.19. Average monthly food consumption per person in 2014/2017

Description	In kg – 2014/2017
Bread and cereal products	6.26/5.67
Meat	5.29/5.28
Raw meat	3.00/3.00
Raw poultry meat	1.53/1.56
Cured meat and other meat products	2.03/2.04
Fish and seafood	0.33/0.29
Fresh milk	3.26/2.99
Yoghurts	0.50/0.52
Cheese and cottage cheese	0.82/0.86
Eggs	12.02/11.42
Oils and fats	1.21/1.11
Fruit	3.59/3.64
Vegetables	8.99/8.24
Sugar	1.19/0.93
Potatoes	n.d./3.16

Source: Author's own compilation based on <http://stat.gov.pl>.

Table 3.19 shows that in Poland, in 2017, households spent PLN 246018 million on food products, while the average monthly expenditure on food and non-alcoholic beverages in total was 24.4%. This gives the food industry first place on the list of expenses incurred by households in Poland in 2017.

As society cannot exist without food, it thus becomes clear that, wherever possible, food businesses should take sustainability into account in their strategies, turning into sustainable production companies and generating sustainable products through clean production processes.

The data presented in Table 3.19 prove that, in an average year, Poles consume mostly eggs, vegetables, bread, cereal products and meat. These products are characterized by a very short shelf life, so consumers purchase them often. Bearing in mind how large the production of food products is, as it constitutes as much as 20% of the total processing industry and that households spend almost 25% of their total expenditure on food products, it can be said that the importance of the food industry is rather significant in view of the entire industrial activity. Therefore, the production of food products must be posing a very high threat to the natural environment, in which all consumers happen to be living. The presented data thus indicate how important the food industry is for the Polish economy. It is necessary for these enterprises to start introducing long-term strategies, taking into account the welfare of current and future generations, because this industry generates a genuine threat to the natural environment and society.

The data presented prove that the structure of consumption on the basis of monthly per capita expenditure has not changed considerably. The data indicate that manufacturing companies are offering increasingly more food products to the market. This is because the number of manufacturing businesses has increased, and the production of food products sold and revenues from their production has also increased significantly. This proves that more and more food products are offered to the market every year, so in terms of sustainability it seems necessary to implement the principles of sustainable development during production activities. Food industry companies should have in their offer a vast majority of ecological and organic healthy foodstuffs (valuable, without preservatives, palm oil, artificial colorings, flavours, flavour enhancers, etc.).

In the following part of the article the results of the primary research will be presented. The research problem is aimed at bringing closer the issue of balancing individual areas of business activity. The research objective is to address the question whether companies are carrying out business activities with an appropriate socio-economic orientation in terms of sustainability. Defining the research objective has determined the decision on undertaking the research. This work is the second part of the research which the author has carried out in large food industry enterprises. The first part concerned the personnel employed in these enterprises, which was described in detail in the publication “Network, Innovation, and Competence-Based Economy” (Kurzak-Mabrouk, 2019).

The conducted research study has made it possible to find the answers to the following research questions: Do business activities in large enterprises (Act, 2004) of the food industry support the concept of sustainable development? Can business activities carried out in large food industry enterprises be managed in a way oriented towards sustainable development in order to contribute to the transformation of enterprises into enterprises clearly oriented towards sustainability? In order to carry out the study correctly, four basic stages were implemented (Stachak, 2013) involving preparing the proper study itself, gathering factual knowledge about the current state of the food industry, formulating the generalizations made so that, ultimately, a scientific text could be finally written.

For the purpose of collecting the necessary information, the form of an interview that was carried out in accordance with a previously prepared questionnaire was used for the purposes of this scientific study. In this method, a prepared form is used, which serves to organize and order the questions that are supposed to be asked, and the investigator contacts specific respondents directly to get the correct answers to the questions on the form (Stachak, 2013). The answers given by the respondents provide the relevant data. These questions relate to important facts about the activities of companies. The answers given are fully recorded on the form. Another method of indicating the relevant question to the respondents is to use the instruction manual indicating a set of questions that they are expected to answer (Frankfort-Nachmias & Nachmias, 2001).

The questionnaire was divided into two main parts. The first part covered the analysis and characteristics of their company, while the second part was aimed at showing whether and to what extent individual areas of their business activity were equalized in their companies, which resulted in the devising of an authorial model of what a sustainable business should look like in all areas. After creating an appropriate and relevant set of questions, using statistical methods, a representative sample of large companies was selected for the survey aimed at reflecting its credibility. The Central Statistical Office (GUS)⁹ provided relevant information that 244 large food industry enterprises were active in Poland as of 31 May 2018. Out of them, 16 were selected with a clear purpose (non-randomly) so that the targeted selection proved to correspond with the research in an individual, harmonized way. For the research sample to be representative, the following statistical calculation for the finite population (when the size of the studied population is known) was used:

$$n=0.25/((d^2/u\alpha^2)+(0.25/N)) \quad (1)$$

⁹ According to the data from the Central Statistical Office (GUS), these are the data for companies which employ over 250 employees.

where:

n – minimum sample size,

d – maximum error of estimation,

ualfa – the value read from Table 3.20 with a standardized probability distribution,

N – population size,

d shouldn't exceed 20% and ualfa 10%.

Table 3.20. Selection of a representative sample to be surveyed from among 244 companies

Case	Population	Maximum estimation error (d)	Alpha	Ualfa	Minimum sample size (n)	Minimum sample size (rounded)
1	244	0.001	0.1	1.644853627	243.912011	244
2	244	0.01	0.1	1.644853627	235.5043948	236
3	244	0.05	0.1	1.644853627	128.2959922	129
4	244	0.02	0.1	1.644853627	213.2314794	214
5	244	0.1	0.1	1.644853627	52.95818872	53
6	244	0.2	0.05	1.959963985	21.85830375	22
7	244	0.2	0.1	1.644853627	15.8137264	16
8	244	0.1	0.05	1.959963985	68.91289858	69

Primary data were used to conduct the study properly. Knowing the representative research sample, the companies in which the investigation was carried out were selected at random. The relevant information was obtained by the researcher for the needs of the study. During the face-to-face interviews, the responses to the previously prepared questionnaire were completed. The survey was conducted in 16 large food industry enterprises operating on the Polish market, and their geographical distribution is shown in Figure 3.4.

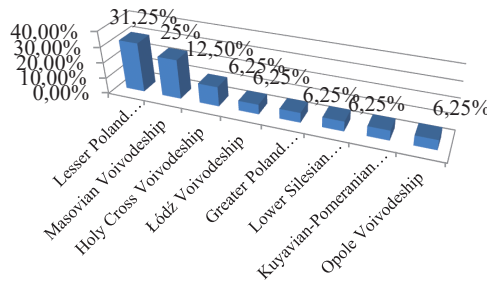


Figure 3.4. Geographical distribution of enterprises that took part in the survey

Source: Author's own compilation based on the conducted study.

The material collected during the research study was obtained from the persons responsible for particular areas of the company’s business activity who were presidents and directors of specific organizational units. After the study had been carried out, the next step was to assess the extent to which large food industry enterprises balance particular areas of their business activity. The study survey was conducted between 1 October and 30 December 2018 based on a questionnaire for a face-to-face interview.

4. Discussion and results

Food business entities that integrate the concept of sustainability into their strategies are concerned about society and the environment, because food production, ingredients supplied by suppliers, energy and non-renewable resources used in their production, transport, disposal and recycling have a negative impact on both. It is possible to minimize the negative impact of food production on consumers and the natural environment throughout the whole value chain presented. Below, the results of the research study, which covered specific elements of business activity conducted by large food industry enterprises, are presented in Table 3.21.

Table 3.21. Organic and pro-social health food businesses contributing to sustainable development (in %)

Item	A. Product	B. Production	C. Logistics	D. Packaging
1	60	50	20	30
2	44	0	0	95
3	26	10	10	50
4	38	10	30	50
5	44	30	30	80
6	52	50	30	50
7	16	20	20	80
8	34	50	30	60
9	34	40	20	50
10	30	0	10	50
11	40	50	30	60
12	22	0	20	0
13	50	20	30	50
14	58	60	40	90
15	22	70	40	95
16	34	50	20	50
Σ	38	32	24	59

Source: Author’s own compilation based on the research study.

Column A of Table 3.21 specifies the food products manufactured by businesses that are offered on the market to consumers. It provides information on which of these companies, and on what scale, produces sustainable products and cooperates with such suppliers. It is important that the goods offered to consumers be as sustainable as possible. The protection of the environment and the health of society must be taken into account as early as at the stage of product creation. An environmental life cycle approach is essential when developing a product and a product should therefore be generated in an environmentally sound manner. In order to meet and satisfy the requirements of consumers, it is necessary to adapt the business to the applicable law but also to the industry's ethical standards. When speaking of a sustainable product, one should think that it is a safe, healthy, non-perishable product, which is created during clean production processes. It is characterized by the highest quality, proper composition guaranteeing that it is free from preservatives and artificial additives, and the fact that its packaging is biodegradable or recyclable. Management systems in companies are responsible for the highest quality and safety of products at all stages. In order to efficiently use the quality management systems in enterprises, it is necessary to observe the applicable law in the EU, Poland, the company's internal regulations and the Food Safety System Standard ISO 22000:2018. In enterprises, it is necessary to eliminate losses and mistakes, to employ staff with pro-social and pro-ecological sensitivity and to act in accordance with the expectations of buyers. Suppliers must also respect the assumptions of quality standards in accordance with the principles of sustainable development and must not use any harmful substances during breeding and fertilization. Entrepreneurs should first enter into cooperation with local and national suppliers where possible and the extent to which it is possible. In Part A of the study, an average out of three analyzed elements was obtained, including how environmentally friendly a given manufactured product was, its health benefits, and cooperation with the local suppliers, which its production involved. The average obtained indicates the percentage in which the generated product can be considered to be sustainable.

Column B concerns production, as the companies that want to conduct sustainable business activity are obliged to minimize the negative impact of their activities on the environment through long-term planning. It is recommended that an environmental management system be implemented through the ISO 14001:2015 Environmental Management standard, which contributes to the improvement of performance in terms of environmental protection. Companies should strive to eliminate the use of those kinds of energy and chemicals that pollute the environment during production processes. Growing demand for food products is caused by the growing global population. The food industry contributes to high consumption of drinkable water, as agriculture uses 70% of

its resources, industry 20%, and households 10%. That is the reason why food companies can no longer ignore the water problem as its resources are limited (Eurostat), so they are beginning to implement responsible management of water and its resources. The data indicate that Poland is in the last – 24th – place among the European countries. In large enterprises, water resources are managed by means of the following measures:

- at each stage of their operations, companies limit the amount of water used per tonne of product produced, e.g. companies with on-site sewage treatment plants use it to clean the production line, and use water from steam production installations for washing vegetables, or cooling equipment;
- innovative technologies help to determine the level of reducing water consumption, recycling and reusing of water is applied and also a closed circuit is implemented, and also
- they efficiently manage their wastewater discharge.

Nonetheless, it is still necessary to promote activities that will contribute to water saving, to encourage suppliers and other stakeholders to such initiatives, and to raise public awareness of water conservation, as this resource is non-renewable and is gradually becoming depleted. It is also advisable to implement ISO 14046:2014, which measures the water footprint.

Part C concerns logistics processes i.e. transport of deliveries and business trips, as the carbon footprint should be reduced in relation to these as well. It is important to optimize truck fill on each load and to make attempts at replacing road by rail transport where possible, as this can reduce carbon dioxide emissions. It is also worth limiting business trips and air transport, which is the largest emitter of carbon dioxide, as the aviation industry emits as much carbon dioxide as an average industrialized country does, currently accounting for 2% of the global emissions (LOT). This can be managed by using innovative solutions offered by new technologies for Internet communication, i.e. video conferencing, for employees who are responsible for international contacts as well as during their training. This reduces costs and time that employees actually waste when making business trips.

Part D relates to packaging. Polish entrepreneurs are legally obliged to partly recover the waste that their enterprise produces and to recycle it. Large enterprises offer to the market a significant part of their goods in recyclable or biodegradable packaging. Table 5 shows the balance of particular areas of business activity indicated in percentage, which is the information obtained from the interviewed representatives of the enterprises included in the study. Those who supervise the production activities of companies know that there is no model for sustainable business operations. This is because sustainable development goes beyond legal regulations and it is a voluntary

choice of the company to introduce changes for the benefit of society and the environment. The results show what percentage of the business activity is sustainable and, therefore, how much less likely it is to have an impact on the environment and consumers.

The objective of this research study, which is to prove whether the companies carry out their business activities in line with the concept of sustainable social and economic development, has been achieved. The sum of columns A, B, C, and D proves that the investigated companies do not fully balance various areas of their activity. However, they are all taking actions in order to become a sustainable enterprise in the future. At this point in time, most of the activities in the companies that are pursuing sustainable development are undertaken in terms of waste and packaging management. This is probably due to the fact that a failure to comply with legal regulations on the part of a company results in significant financial penalties imposed on such company. However, most of them go further than what is required by law, so they voluntarily contribute to the implementation of sustainable development principles in this area of activity. Figure 3.5 illustrates model actions of a pro-social and environmental nature that should be taken by large food industry enterprises when conducting business activity in accordance with the principles of the concept of sustainable development.

It is crucial that a separate position for an employee – a sustainability specialist – be created in a large food industry enterprise and whose responsibility would be trying to balance the business activity as much as possible at all stages of business management (while planning, organizing, motivating and controlling activities) aiming at its sustainability. While planning competitive solutions, it would be necessary to develop conditions that will help to implement sustainable development measures. It is, therefore, necessary to devise a suitable budget that will facilitate the implementation and execution of planned projects. For larger companies, it would be advisable to have a Sustainability Officer in each department, such as a Sustainable Production Officer or a Sustainable Logistics Officer. The knowledge that a sustainability specialist has is essential in order to be able to carry out sustainable operations accurately. A large food company has two options to hire a sustainability specialist. One of them is to appoint a person from among its employees who will be responsible for coordinating sustainability activities. In this case, it will be necessary to refer this employee to specialist training to acquire the necessary knowledge about sustainability. The second possibility is to announce the vacant position in order to conduct the recruitment and selection of a new employee for the position of a sustainable development specialist.

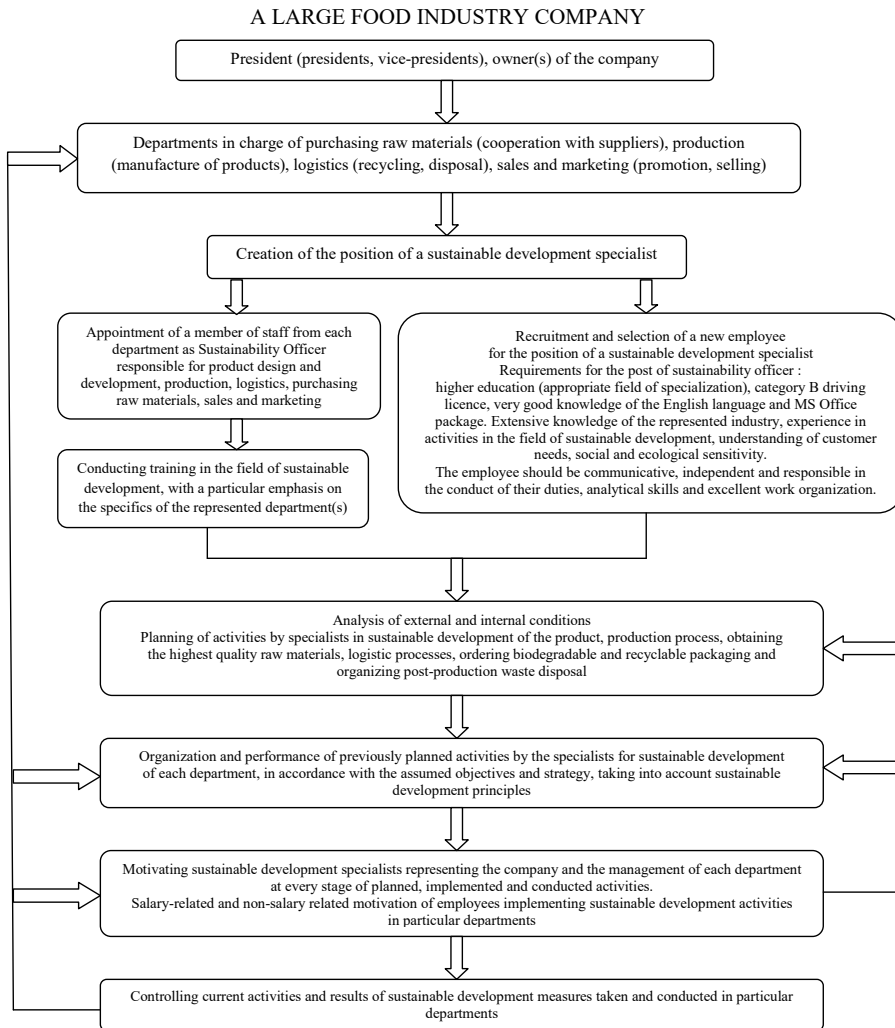


Figure 3.5. Model actions for transforming traditional businesses into sustainable enterprises

Then, each candidate who meets the requirements of the announcement will be invited to an interview as a result of which one person will be selected for the newly created position. Once the position of a sustainability specialist has been filled, it will be necessary to conduct a precise analysis of external

and internal conditions. The next step is to plan activities in each of the departments that contribute to sustainable development.

Once all activities in a large food business have been planned, it will be necessary to organize and implement planned activities within that scope, in accordance with the objectives set, while accounting for the sustainable development principles at all times. Moreover, it is necessary to motivate the sustainability specialist at the levels of the enterprise and the management of a given department, at every stage of activities planned, implemented, and performed. Motivating employees who carry out activities in the field of sustainability can be included in both the payroll and non-payroll systems. Moreover, all current activities should be kept under constant control. Only efficiently performed sustainable business activity will contribute to achieving a competitive advantage by the company. This will allow the company to stand out from the multitude of other companies present on the market, so that it will be noticed and remembered by customers.

It is important that large food businesses focus their strategies on the well-being of societies, not only of the present but also of future generations. Enterprises which, in addition to their profits, also care about consumers and their quality of life, should follow the principles of sustainable development in all their business activities.

5. Conclusions

Large food business operators should minimize the negative effects of their production activities as much as possible when those are being carried out. Their activities are essential for societies to let them live their everyday lives, as food products are essential for life. Businesses' production activities provide consumers with many essential ingredients and foods necessary for the proper functioning of the body. In order to implement, as effectively as possible, the model of the organization and to conduct sustainable business activities in a large food business, certain principles need to be met. When setting business objectives, it is necessary to implement sustainable development as early as at the stage of devising strategies. When designing products, it is also important to ensure that they are imprinted with the characteristics of sustainability. The principle of sustainable development must be taken into account at each stage including production, distribution, and maintaining contacts with contractors, as well as the stage of disposal of post-production waste. This will be possible if the president, his/her deputies, directors, managers as well as employees at the lowest levels are environmentally and socially sensitive. The vertical, as well as horizontal, communication between them must be smooth and transparent. Experienced and well-qualified staff is a basic prerequisite so that

the sustainable business activities of a large company are integrated and as efficient as possible.

The food industry in Poland covers 20% of all processing industry in terms of business entities. Thus introducing innovations in these companies is conducive to implementing sustainable development into their strategies. Production is highly damaging to both people and the environment, and efforts should be made to ensure that it becomes increasingly sustainable.

The actions presented in the article, which can be implemented by entrepreneurs, illustrate how sustainable business activity in the food sector should look like in order to contribute as much as possible to the protection of society and the environment. The industrial activity from an expansive one should start to turn gradually into a sustainable one. Only through this concept can the degradation of nature and the depletion of already scarce, natural, non-renewable resources be stopped.

The goal set at the beginning of the article has been achieved as a review of the actions that should be taken by food businesses, resulting from the implementation of the principles of the concept of sustainable development into their strategy. Their incorporation will contribute to the reduction of the negative impact of production activities on the planet, which will allow society to live in a cleaner natural environment. Innovative actions introduced by enterprises, as a consequence of implementing the principles of sustainability into their strategies, serve to improve the quality of life of present and future generations. Enterprises that have a very large number of consumers cause a lot of damage to the natural environment due to the extent of their activities. The aim of the article has been achieved by providing the answers to the research problem.

In order to improve the quality of life of societies in a clean natural environment, it is necessary to make efforts for all production companies in the food industry and beyond in order to implement the presented sustainable development activities. It is of great importance to promote, popularize and educate both the producers carrying out business activities and society, so that customers turn to purchasing sustainable products created in no other than the process of clean production. The cooperation of entrepreneurs, authorities, media, and consumers in this area can be expected to make the implementation of sustainable development principles successful.

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Biographical note

Anna Kurzak-Mabrouk, Ph.D., Assistant Professor at the Faculty of Law and Economics of the University of Humanities and Natural Sciences J. Długosza in Częstochowa. She is a graduate of doctoral studies at the Częstochowa University of Technology, Faculty of Management at the Institute of Marketing and Postgraduate Studies in Public Administration, as well as in European Union Studies. She specializes in economics, sustainable development, and marketing communication. She takes part in numerous international and national conferences and has authored many scientific publications. She conducts research on innovation in management and marketing and is the author of more than 70 scientific papers or books.

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Diagnosing the network relationships of a local government unit: A case study

Marcin Flieger¹

Abstract

The article aims to identify the different types of relationships within a local government's network, according to the level of network collaboration maturity, based on the example of the Zgorzelec commune. Although in recent years, issues concerning the network trend have been explored more and more, it has been done mainly in the context of the private sector. Still, very little attention is put on the question of the intentional creation of network relations and its influence on the collaborative advantage of public organizations, including local government institutions. Therefore, the article focuses on filling this gap by deepening the analysis of the network trend and increasing the efficiency of realized tasks from the perspective of public sector organizations. At the beginning, the very idea of a relational approach in analyzing inter-organizational networks is explained, and then the author operationalizes a commune's network relations features, dividing them into four dimensions. After, the levels of network collaboration maturity are identified. All the above considerations constituted the grounds for carrying out a case study, within which the author identified the degree of appearance and the character of evolution of network relations' features. As a result, it is possible to present how a commune creates network relations as it achieves another level of maturity. An understanding of the process constitutes a vital aspect of the efficient development of network collaboration and building a commune's collaborative advantage.

Keywords: *network, network collaboration, network relations, collaborative advantage, commune*

¹ Marcin Flieger, Ph.D., Adjunct, General Tadeusz Kościuszko Military Academy of Land Forces, Faculty of Management, ul. Czajkowskiego 109, 51-147 Wrocław, Poland, e-mail: marcin.flieger@awl.edu.pl (ORCID ID; 0000-0002-6810-7141).

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1. Introduction

Analyzing a network from a structural perspective (number and position of actors, heterogeneity, and density) does not allow reaching conclusions concerning the efficiency of the network (Czakon, 2012) and the benefits gained by its members. This problem is visible, especially in the case of communes, since the structure of local public networks depends considerably on the territorial character of a commune. Thus, scrutiny ought to concentrate on the essence of relations between partners. Analysis of a single relation constitutes an elementary analysis, which is developed within the confines of the examination of inter-organizational bonds (Czakon, 2012). As a result, there appears the need to treat relations in an instrumental way, to choose the kind of relations consciously in order to achieve set objectives. Therefore, the presented analysis concentrates on an inter-organizational network from a relational perspective (Kilduff & Tsai, 2003; Zaheer, Gozubuyuk, & Milanov, 2010).

A commune constitutes the most important public organization at the local level, and one of the key aspects of increasing the efficiency of completing tasks is the ability to develop collaboration with other organizations that operate in a region (Furmankiewicz, 2002). Hence, a fundamental question arises: in what way does a commune build network relations in order to achieve the expected benefits from network collaboration? Understanding this phenomenon, according to another level of network collaboration maturity, constitutes a significant contribution to the knowledge concerning the proper development of interactions between partners and, consequently, an increase in the efficiency of the process of providing public services and creating public value.

2. Literature background

2.1. Features of a commune's network relations

After a semantic and comparative analysis of the classification of network relations' features presented in the literature, as a base for making a list of features, the author used the classification proposed by Czakon. He presented three attributes of network relations: exchange, involvement, and reciprocation (Czakon, 2005; 2007). Having included the views of Easton (1992), Anderson, Hakansson, and Johanson (1994), the author operationalized the features of a commune's network relations with organizations operating in a region, ultimately dividing them into four dimensions (each of which includes a list of network relations' features):

1) Exchange:

- information exchange,
- material exchange,
- energy exchange.

2) Involvement:

- expectation of continuing and deepening relations,
- investing in co-specialized resources,
- developing informal relations,
- developing formal relations,
- embeddedness,
- building mutual trust,
- building loyalty,
- building shared values,
- avoidance or de-escalation of conflicts.

3) Reciprocation:

- expectation of equal efforts,
- identifying common objectives,
- common planning and making decisions,
- common problem solving,
- adapting to partners' needs.

4) Co-dependence:

- making partners dependent on resources controlled by commune,
- taking control over partner's resources,
- exploiting an administrative position of power.

Three forms of exchange take place within the inter-organizational relations created, which in turn ought to be understood as an element of interaction between an organization and its environment. It is vital that the exchange is mutual and is realized in both directions. At the same time, it is the sort of exchange that is characterized by repetitiveness, organizational autonomy, and a lack of hierarchy. It is realized together with market transactions and within-organization allocation of resources (Czakoń, 2005).

Involvement concerns orientation on deepening and widening exchange relations (Anderson, Hakansson, & Johanson, 1994). In the case of inter-organizational networks, involvement has a multi-level character and constitutes an essential factor that allows avoiding opportunistic behavior. Dyer (1997) lists four basic types of involvement: operational, informational, invest, and social. According to this classification, the features of a commune's network relations in the involvement dimension were operationalized. Attention was put on the expectation of the continuing and increasing frequency of relations, together with investing in co-specialized resources. One of the crucial decisions concerns the dilemma as to whether a commune should develop formal or informal bonds. Regarding the social aspect, involvement through

embeddedness was identified. This led to the question of building trust, loyalty, and shared values. The final, very important feature concerns avoiding or de-escalating conflicts between members of a network.

Reciprocation regards the expectation of balance, symmetry between partners. It constitutes a vital and, at the same time, very natural completion of the involvement dimension. From the perspective of a network member, they assess their own effort put into collaboration, and they expect a similar effort (reciprocation) from other members. This mutuality concerns exchange symmetry as well as coordinated planning, making decisions, solving problems, and adapting to partners' needs.

The literature on network relations presents two ways of perceiving reciprocation: based on equality and based on power. According to the first one, the process of creating ties is voluntary, and partners have equal rights (equal position). In this case, organizations initiate network collaboration in order to realize common and individual goals more efficiently. The second concept suggests that the development of network relations is supposed to lead to dominating partners and taking control of their resources, and some organizations might collaborate under compulsion (Holmlund & Törnroos, 1997; Olivier, 1990, after Czakon, 2007).

Given that there are two ways of understanding reciprocation, and the fact that the presented research concerns building network relations from the perspective of a commune, it became justified to add a fourth dimension: co-dependence. It is closely linked to the reciprocation dimension from the perspective of a based-on-power attitude. At the same time, it corresponds with the network relations typology proposed by Easton (1992) and Ford, Gadde, Hakansson, and Snehota (2003). Although theoretically, the network collaboration concept is based on partnership, free choice, and mutual benefits, the position of the actors is not always equal. Often, an egoistic behavior appears that attempts to appropriate value, taking control of partners' resources, and making them dependent on the resources of other partners. In this context, it ought to be stressed that a commune, thanks to its legal status, has the possibility to exploit a power position. Thus, there is a natural potential that allows communes to attempt to dominate other members of the network. Taking all these conditions into consideration, the fourth dimension of co-dependence was included in the research.

Identified network relations' dimensions correspond with the idea of bonds dynamics (Kickert, Klijn, & Koppenjan, 1997). Presented features evolve as the relations develop in the process of achieving another level of maturity. Each feature is assessed by an organization, and it influences the process of learning, adapting, or withdrawing from collaboration.

2.2. Levels of network relations maturity

Building an optimal structure of a network constitutes a process that consists of stages (levels), leading to achieving network relations maturity (Baker, 1992). Most often, collaboration is initiated by the common coordination of some actions. At this stage, ties are loose, often informal, and common actions do not generate considerable risk. Organizations have an opportunity to know one another better and understand partners' needs, expectations, and possibilities of gaining mutual benefits. In time, relations evolve and ultimately they might achieve a stage of partnership. Ties become tighter, the realized tasks are more complex, and they generate more risk.

Taking the above into consideration and the nature of a commune as a public organization, the following four levels of network relations maturity in collaboration between a commune and other organizations in a region were identified (Furmankiewicz, 2002; Krajewski & Śliwa, 2004; Bończak-Kucharczyk, Herbst, & Chmura, 1998; Cieślak & Kołodkiewicz, 2014; Słomińska, 2007):

- 1) Informing.
- 2) Consulting.
- 3) Common projects – operational local initiatives.
- 4) Strategic partnership – continuous collaboration based on a shared vision and long-term objectives.

3. Research approach and methods

The research was carried out using the method of a case study, following its methodological rigor (Eisenhardt, 1991). The choice of the method is a consequence of set research objectives and the stage of knowledge development in the analyzed research area. The operation of inter-organizational networks is still a relatively new phenomenon that has developed dynamically, conditioned by numerous variables. There is a need for a thorough examination that would allow formulating propositions of features and the development of the phenomenon in question. Therefore, the research carried out is interpretative (Eisenhardt & Graebner, 2007) and leads to an in-depth understanding of the phenomenon in some particular context (Chetpa, 2002).

Taking into consideration the complexity of the phenomenon and the variety of information characteristics for a case study method, the author implemented a strategy of triangulation of gathering data methods (Yin, 2014), which included an expert interview and documents analysis. The in-depth group interview was carried out in September 2019 with the director of Funds and Development Unit, the director of Promotion and International Affairs Unit, an inspector for

collaboration with NGOs, a city office secretary, and a city office spokesperson. The interviewees filled in a relational matrix that allowed the identification of the degree of appearance and evolution of network relations' features, according to the level of maturity. Moreover, semi-structured forms were used, which included questions regarding the specification of the office's network collaboration at each level of maturity and the character of every network relations' feature. The data was coded according to the adopted conceptual frames (*a priori* codes) (Miles & Huberman, 2000). Document analysis identified the conditions of realizing tasks and the possibilities of initiating and developing collaboration with organizations operating in the region. They included the office council's resolutions, commune development programs, programs for collaboration with NGOs, legal acts, and statistical reports.

A case study was carried out on the example of the city office of Zgorzelec. The key criterion of choice was the clarity of the case – the analyzed office initiates and develops network collaboration in an active way. Hence, the gathered data is very reliable since it is based on real experience at each level of network collaboration maturity. The additional criterion was the access to crucial data – the possibility of carrying out an interview with public managers and analyzing the internal documents of their office.

The population of the commune of Zgorzelec is over 30 thousand inhabitants. The commune is located in Lower Silesia province, zgorzelecki powiat, at the junction of three countries (Poland, Germany, and the Czech Republic). It is characterized by a very well developed communication infrastructure (A4 highway). Cultural diversity results in high activity of non-governmental organizations (NGOs). As a consequence, the commune is a very attractive place to settle down and locate businesses, including international organizations. On the commune territory, there are 3985 registered enterprises and 169 non-governmental organizations. The city office of Zgorzelec is a member of three commune (city) associations, and it cooperates with four partnership cities.

4. Results and discussion

4.1. Creating network relationships according to the levels of network collaboration maturity

Network relations' features in the exchange dimension were assessed very high at all maturity levels, but the highest degree was identified at the level of common operational projects (Table 3.22). However, the interviewees emphasized that *'the assessment does not include relations with entrepreneurs, but only with non-governmental organizations and local administration*

institutions.' Material exchange was most visible, but at the first two levels of maturity, it concerned mainly promotional expenses. From the city office's perspective, *'information exchange is most intensive in the relations with other public organizations,'* and energy exchange appeared in the interaction with non-governmental organizations. In the case of business organizations, there appeared little information exchange, only at the first two levels of maturity. *'It is a result of very limited relations between the city office and entrepreneurs,'* their passive approach had led to the lack of common projects realized within the confines of network collaboration.

Features in the involvement dimension were also graded very high, although in some cases, features were assessed separately (very low) for the relations with entrepreneurs. From the city office's perspective, *'avoiding or de-escalating conflicts are most important. It is achieved by thorough consultations of possible solutions. Avoiding conflicts is especially difficult at the level of common projects' realization*'. Expectation of continuing and deepening relations was the second crucial feature. For the office, the expectation of collaboration development was vital at all maturity levels, also in the situation when relations were very limited. In this case, interviewees referred to the lack of real cooperation with entrepreneurs – and despite the fact that it was very limited, there was still a very strong expectation and a will to develop these relations. Regarding the collaboration with non-governmental and public organizations, the highest grades concerned: investing in co-specialized resources (mostly in knowledge and learning how to realize projects together), developing both formal and informal relations, and embeddedness. In the case of relations with entrepreneurs, these features did not occur, except for a very low degree of keeping informal relations. Concerning other features from the involvement dimension, building mutual trust, loyalty, and shared values were assessed at an average level. Regarding the shared values, *'the city office attaches importance to creating relations in the way which allows conjuring up local patriotism.'*

In the reciprocation dimension, the dominating features were the expectation of equal efforts and common planning and making decisions, especially at the two highest levels of network collaboration maturity. However, the assessment did not concern relations with entrepreneurs – in this case, the anticipation of equal efforts was very low at all maturity levels, and there was a lack of common decision making. The interviewees emphasized that *'expectation of equal efforts and common planning is most important in collaboration with non-governmental organizations because the office values highly having positive relations and realizing initiatives with organizations which represent local inhabitants.'* In the case of collaboration with public organizations, however, the key feature concerned solving problems together (mainly in the form of

informal meetings). It resulted from the fact that these public organizations participated actively in organizing local public life and they constituted a vital element of the process of providing public services. It was also stressed that *'the office has had a very negative experience concerning the identification of common objectives. In the past, the city office made an attempt to identify them, but without consulting with potential partners. As a consequence, the objectives were identified in a wrong way, which affected the relations negatively'*. This experience was the reason for assessing the feature in question at an average degree. Finally, regarding adapting to partners' needs, it was underlined that this feature was least visible in relations with entrepreneurs and in the case of collaboration with non-governmental organizations, an important limitation in adapting behavior was constituted by law regulations, which detail precisely the conditions and possibilities of developing collaboration.

Making a partner dependent on resources controlled by the city office and exploiting an administrative position of power were the two features pinpointed from the co-dependence dimension by the interviewees. In the case of interactions with entrepreneurs, making them dependent on the office resources was least visible, and it concerned only the two first levels of network collaboration maturity. Thus, this feature was most visible in the cooperation with non-governmental organizations and it concerned the range of tasks commissioned to NGOs and the policy of making communal resources available for the organizations. Regarding the collaboration with other local public organizations, the feature in question occurred in relations with neighboring communes. *'There are situations in which doing some task or organizing some event by a neighboring commune requires making available some terrain controlled by the city office of Zgorzelec.'* Regarding the second feature, exploiting an administrative position of power concerned organizations from all sectors. However, in the case of entrepreneurs, it occurred only at the level of informing and consulting (as a natural consequence of the lack of realizing common projects at the two highest maturity levels) and took the form of making administrative decisions regarding the realization of some infrastructure investments. Interviewees stressed that often the office had to face various contradictory demands and expectations of different groups and organizations, and, as a result, it was forced to exploit its dominating administrative position to complete the investment. In the case of collaboration with non-governmental organizations, exploiting an administrative position of power occurred in the process of commissioning tasks and granting subsidies. *'If only there is room for interpretation of regulations, the office can make decisions which are best from the office point of view,'* e.g. giving a chance to new NGOs in order to assess their trustworthiness and professionalism.

Thus, as presented in Table 3.1, the degree of appearance of network relations' features changes as the office achieves another level of maturity. At the first three levels, the office mostly implements an exploiting strategy, only in a few cases the exploring strategy. However, when achieving the fourth level, some features are being limited.

Table 3.22. Degree of appearance and evolution of network relations' features

	Network relations' features	Level I	Level II	Level III	Level IV
Exchange	information exchange	**	**	**	**
	material exchange	***	***	***	**
	energy exchange	**	**	***	**
Involvement	expectation of continuing and deepening relations	**	**	**	**
	investing in co-specialized resources	***	***	***	**
	developing informal relations	**	**	**	**
	developing formal relations	**	***	***	**
	embeddedness	**	**	**	**
	building mutual trust	**	**	**	**
	building loyalty	**	**	**	**
	building shared values	**	**	**	***
	avoidance or de-escalation of conflicts	***	***	***	***
Reciprocation	expectation of equal efforts	**	**	***	***
	identifying common objectives	**	**	**	**
	common planning and making decisions	**	**	***	***
	common problem solving	**	**	**	**
	adapting to partners' needs	**	**	**	**
Co-depend.	making partners dependent on resources controlled by commune	**	**	**	**
	taking control over a partner's resources	-	-	-	-
	exploiting an administrative position of power	*	*	**	*

Note: Degree of appearance: *low; **average; ***high.

5. Conclusion

Scrutiny allowed a more thorough understanding of the relational and dynamic characteristics of networks, which constitute crucial value for the development of network science (Watts, 2004; Hudson, 2004; Isett & Provan, 2005; Moller & Wilson, 1995). Network collaboration may bring benefits not only for

entrepreneurs but also for organizations from the public sector (Lane, 2000). It becomes a vital part of network governance for public institutions, even at a local government level (Klijn, 2008; Hooghe & Marks, 2001). Hence, the author aimed at filling a research gap concerning the shortage of research on the way a commune builds network relations in collaboration with other organizations operating in a region, according to the levels of network collaboration maturity. The research carried out showed that the analyzed city office actively creates various network relations' features and their character changes as the cooperation gets into another maturity level. The office uses all the features from the exchange, involvement, and reciprocation dimensions. The most visible are: material exchange, investing in co-specialized resources, avoidance, or de-escalation of conflicts. A high degree of appearance also concerns the following features: developing formal relations, expectation of equal efforts, common planning, and making decisions.

Network relations' features from the co-dependence dimension have the least importance. They are directly connected with the specific position of the office as a local public administration institution. Thus, the office exploits its dominating position to a very low degree. Some features (taking control over a partner's resources) do not appear at all. The interviewees claimed that taking advantage of their administrative position would be against the idea of partnership and the principles of network collaboration. The office prefers not to initiate cooperation at all rather than force other organizations against their will and expectations.

The results confirmed the correctness of the operationalized classification of network relations' features. The city office of Zgorzelec exploits all the features within the confines of the four dimensions. As the maturity level changes, the office implements three strategies: exploitation, exploration, and limitation. However, the features are limited only as the collaboration develops from operational projects into a strategic partnership. By including in the research the co-dependence dimension, it allowed the extent to which the commune exploited its power position to be identified. It appeared that despite its legal status, which corresponds with the based-on-power views presented by Holmlund and Törnroos (1997), the office exploits the features from the fourth dimension to a very low degree at all network collaboration maturity levels.

An awareness and understanding of the possibilities and conditions of building network relations with other organizations operating in a region constitute a fundament for achieving various network benefits and, as a consequence, the effective creation of the office's collaborative advantage (Lank, 2007; Huxham, 2000, 2003; Huxham & Vangen, 2000, 2010, 2013; Vangen, Hayes, & Cornforth, 2015). However, it ought to be stressed that the methods used and the research carried out were aimed at understanding

some particular phenomenon and gaining information about chosen, crucial issues concerning the development of network collaboration in a commune. Therefore, potential further research ought to include creating hypotheses that would be verified statistically using quantitative methods.

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Biographical note

Flieger Marcin, Ph.D., is an assistant professor at General Tadeusz Kosciuszko Military University of Land Forces in Wrocław, Faculty of Management. His scientific work concerns mostly issues connected with optimizing the functioning of public administration units, the conditions of implementation of modern management concepts, and effective management of organizations' image.

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